UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

Note to Reader
September 9, 1998

Background: As part of its effort to involve the public in the implementation of the Food Quality Protection Act of 1996 (FQPA), which is designed to ensure that the United States continues to have the safest and most abundant food supply, EPA is undertaking an effort to open public dockets on the organophosphate pesticides. These dockets will make available to all interested parties documents that were developed as part of the U.S. Environmental Protection Agency's process for making reregistration eligibility decisions and tolerance reassessments consistent with FQPA. The dockets include preliminary health assessments and, where available, ecological risk assessments conducted by EPA, rebuttals or corrections to the risk assessments submitted by chemical registrants, and the Agency's response to the registrants' submissions.

The analyses contained in this docket are preliminary in nature and represent the information available to EPA at the time they were prepared. Additional information may have been submitted to EPA which has not yet been incorporated into these analyses, and registrants or others may be developing relevant information. It's common and appropriate that new information and analyses will be used to revise and refine the evaluations contained in these dockets to make them more comprehensive and realistic. The Agency cautions against premature conclusions based on these preliminary assessments and against any use of information contained in these documents out of their full context. Throughout this process, if unacceptable risks are identified, EPA will act to reduce or eliminate the risks.

There is a 60 day comment period in which the public and all interested parties are invited to submit comments on the information in this docket. Comments should directly relate to this organophosphate and to the information and issues

available in the information in this docket. Once the comment period closes, EPA will review all comments and revise the risk assessments, as necessary.

These preliminary risk assessments represent an early stage in the process by which EPA is evaluating the regulatory requirements applicable to existing pesticides. Through this opportunity for notice and comment, the Agency hopes to advance the openness and scientific soundness underpinning its decisions. This process is designed to assure that America continues to enjoy the safest and most abundant food supply. Through implementation of EPA's tolerance reassessment program under the Food Quality Protection Act, the food supply will become even safer. Leading health experts recommend that all people eat a wide variety of foods, including at least five servings of fruits and vegetables a day.

Note: This sheet is provided to help the reader understand how refined and developed the pesticide file is as of the date prepared, what if any changes have occurred recently, and what new information, if any, is expected to be included in the analysis before decisions are made. **It is not meant to be a summary of all current information regarding the chemical.** Rather, the sheet provides some context to better understand the substantive material in the docket (RED chapters, registrant rebuttals, Agency responses to rebuttals, etc.) for this pesticide.

Further, in some cases, differences may be noted between the RED chapters and the Agency's comprehensive reports on the hazard identification information and safety factors for all organophosphates. In these cases, information in the comprehensive reports is the most current and will, barring the submission of more data that the Agency finds useful, be used in the risk assessments.

Jack Housenger, Acting Director
Special Review and Reregistration
Division

April 2, 1998

MEMORANDUM

SUBJECT: OCCUPATIONAL AND RESIDENTIAL EXPOSURE ASSESSMENT AND RECOMMENDATIONS FOR THE REREGISTRATION ELIGIBILITY DECISION DOCUMENT FOR ETHOPROP

FROM: Kathryn Boyle, Chemist /s/
Reregistration Branch 1
Health Effects Division (7509C)

THROUGH: Jeffrey Dawson, Chemist /s/
And
Whang Phang, Branch Senior Scientist /s/
Reregistration Branch 1
Health Effects Division (7509C)

TO: Kit Farwell, DVM
Reregistration Branch 1
Health Effects Division (7509C)

Please find attached the Occupational Risk Assessment for the HED RED Chapter for ethoprop. The assessment was performed by Versar, but has undergone secondary review and revision in RRB1. The assessment has been revised to reflect current HED policy.

DP Barcode: D239295

Pesticide Chemical Codes: 041101

EPA Reg Nos: 264-456, 264-457, 264-458, 264-465, 264-469, 264-546, and 34704-710

264-459, 264-464, 264-475, 264-521, 264-541, and 51036-80 are said to be "inactive" by the registrant, but since the labels do exist, they must be considered in the occupational assessment. See Appendix 1.

PHED: Yes, Version 1.1

cc: files
Judy Loranger, SRRD

ETHOPROP

OCCUPATIONAL EXPOSURE CHAPTER

In this document, intended to support the development of the Ethoprop Reregistration Eligibility Decision Document (RED), HED presents the results of its review of the potential human health effects of occupational exposure to ethoprop.

An occupational and/or residential exposure assessment is required for an active ingredient if: (1) certain toxicological criteria are triggered, and (2) there is potential exposure to handlers (mixers, loaders, applicators, etc.) during use, or to persons entering treated sites after application is complete. For ethoprop the toxicological criteria are triggered by the determination that ethoprop is a "likely" human carcinogen. Potential exposure can occur as a result of agricultural uses.

At this time, products containing ethoprop are intended for occupational uses only. No homeowner uses are referenced on any ethoprop labels reviewed. The 10% golf-course turf product 264-546 contains the statement "not for use on domestice turf grass."

Use Summary

Use Patterns

Ethoprop, O-ethyl S,S-dipropyl phosphorodithioate, is an organophosphate insecticide, nematicide and fungicide (e.g., suppression of white mold on peanuts) used in agricultural settings and on golf-course turf. Ethoprop is formulated as a technical-grade manufacturing product (95% ai), as granular products (3%, 5%, 10% and 15% ai), an emulsifiable concentrate (46% and 69.6% ai), two granular "Lock 'n Load" products (10% and 20% ai) and as a gel in water-soluble packaging (68.2% ai). The following formulations are labeled for "Restricted Use": 264-469, 264-457, 34704-710, 264-458, 264-459, 264-521, 264-464, and 264-541.

Ethoprop is applied as a pre-plant or pre-emergent insecticide/nematicide or fungicide in the following agricultural settings: bananas, beans (dry, snap and lima), cabbage, sweet and field corn, cucumber, peanuts, pineapple, plantains, sugarcane, sweet potato, tobacco, and white potato. It is also used on field-grown ornamentals (e.g., trees, shrubs, bulbs) and on golf course turf. Appendix 1 summarizes labels known to be in existence at this time. Note that the registrant has indicated in letters dated December 16, 1997, and February 6, 1998, that the use on citrus seedlings will be deleted, that the 24(c)'s on lilies will be cancelled, that peanut pegging will be deleted, and that the SLN for citrus in Florida will be cancelled.

Ethoprop can be applied by the use of chemigation, groundboom sprayers, hand held sprayers (e.g., low-pressure handwand and backpack sprayers), aircraft (granular formulations - only to potatoes), tractor-drawn granular spreaders, by slitting (i.e., subsurface insertion of granules into golfcourse turf) and with push-type granular lawn spreaders. In addition, it can be

applied as a dip, by hand (granular), and by hand-pouring of liquid concentrate from a measuring cup/vessel. The use of a belly grinder for application to turfgrass is prohibited. The insecticidal activity of ethoprop is highly dependent on incorporating the material into the soil (mechanically or with water) soon after application.

Aerial application seems unlikely for most of the registered crops, since the product must be immediately incorporated following application and is often applied as a band treatment. On the emulsifiable concentrate ethoprop label, aerial application on potatoes is specifically prohibited. Aerial application of the granular formulation to potatoes is specified on three labels (i.e., EPA Reg. 264-457; 264-465; 264-469). Hence, exposures and risks associated with aerial application are addressed in this document only with regard to the use of the granular product on potatoes.

According to the registrant, greenhouse use is "negligible or nonexistent" even though labeling does not preclude this use pattern.[2] Sod farm uses are also not referenced on any label except the technical product, which is labeled for "commercial turf." The aerial, greenhouse use, and sod farm scenarios should be addressed during label development to ensure that these use scenarios are not permitted without a further assessment.

Usage Pattern

The following paragraphs describe the two different formulation types of ethoprop (granular and emulsifiable concentrate), the crops on which they are used, their application rates, and the corresponding number of treatments per season. The application rate is the maximum amount of product active ingredient (ai) applied in a single treatment.

Granular Products

There are two Lock n' Load granular formulations (10% and 20% ai); the latter is labeled for restricted use only. There are also one 15% granular product and two 10% granular products; one of the latter is labeled for use on field or sweet corn only, and one for golf-course turf only. Of seven "Special Local Need (SLN)" registrations, six [sweet corn; white potato, sugarcane and pineapple] are tied to the 10% Lock n' Load formulations, and one [field-grown lily bulbs] is tied to a different 10% granular formulation.

The lowest recommended label application rate is 1 lb ai./A on corn, and the highest recommended label application rate is 12 lbs. ai/A on white/Irish potatoes and tobacco, with the maximum application rates ranging from 2 to 12 lbs. ai/Acre (lbs. ai/A). Hand application of granules around banana/plantain results in an application rate of 26 lbs. ai/A. The range of recommended label application rates on golf-course turf is 10 to 20 lbs. ai/A. Note that granular products are not labeled for use on nursery ornamentals, with the single exception of a SLN on field-grown lily bulbs.

Maximum Granular Application Rates:

- Banana & plantain (26 lbs. ai/A; repeat application in 6 months)
  It is noted that this rate is on the granular 10% lock n load packaging. It is unclear how a lock n load product can be sprinkled around banana and plantain trees
- Beans (snap and lima) (8 lbs. ai/A; from 3 days before planting to at-planting)
- Cabbage (5 lbs. ai/A; from one week before planting to at planting)
- Corn (4 lbs. ai/A; at cultivation after plant emergence until layby or 3 days before planting to at planting)
- Cucumber (2 lbs. ai/A; at or just before planting)
- SLN Field-grown lilies (40 lbs. ai/A; at planting)
- Peanut (6 lbs. ai/A; one week before or at planting; at pegging)
- SLN Pineapple (12 lbs. ai/A; pre-plant, spot applications as necessary 3 to 6 months after planting, but not within 120 days to harvest)
- Potato (12 lbs. ai/A; from 2 weeks before to at planting; before potato emergence)
- SLN Sugarcane (6 lbs. ai/A; at planting)
- Sugarcane (4 lbs. ai/A; at planting)
- Sweet potato (8 lbs. ai/A; 2-3 weeks before planting)
- Tobacco (12 lbs. ai/A; 1 week before to at planting)
- Golf course turf (20 lbs. ai/A; with repeat applications "as needed" up to 40 lbs. ai/A/yr)

Emulsifiable Concentrate

There are two emulsifiable concentrate (EC) formulations 69.6% (restricted use) and a a 46% ethoprop product labeled for use on tobacco. Thee is also a 68.2% Gel-Tec Water Soluble Pak. There are two “Special Local Need (SLN)” registrations, one for sweet corn, and one for non-bearing citrus seedlings.

The lowest recommended label application rate is 1 lb ai/A on corn, and the highest recommended label application rate is 12 lbs. ai/A on white/Irish potatoes and tobacco with the maximum application rates range from 2 to 12 lbs. ai/A. Hand application of undiluted EC around banana/plantain results at an application rate of 26 lbs ai/A. EC ethoprop products are also used on field-grown ornamentals (from 3 to 6 lbs ai/A). An SLN for use on non-bearing citrus by dipping, by pot drench, and by spraying soil surfaces and citrus tree trunks results in an application rate of 4.957 lbs. ai/A according to the Agency’s LUIS report; however, how this rate was calculated is unclear. Note that EC products are not labeled for use on golf-course turf.

Maximum EC Spray Application Rates

- Banana & Plantain (26 lbs. ai/A; repeat application in 6 months)

- Beans - Snap & Lima (8 lbs ai/A; up to 3 days before or at planting; one application per crop)
- Cabbage (5 lbs. ai/A; up to 1 week before or at planting; one application per crop)
- Non-bearing Citrus (5 lbs. ai/A; bare root or tuber dip pre-plant or pot-drench)
- SLN Non-bearing Citrus (5 lbs. ai/A; at least 12 months before fruiting, by band, broadcast spray or irrigation, no more than two applications per season)
- Corn - Field and Sweet (4 lbs. ai/A; at planting, one application per crop)
- SLN Corn- Sweet (6 lbs. ai/A; at 1 week pre-plant or at planting, one application per crop)
- Cucumber (2 lbs. ai/A; at or just before planting, one application per crop)
- Field nursery stock ornamentals (6 lbs. ai/A; soil broadcast treatment 72 hours prior to planting)
- Peanut (6 lbs. ai/A; up to 1 week before or at planting, one application per crop)
- Pineapple (6 lbs. ai/A; at or within 2 months of planting via drip irrigation, reapply every two months, with limit of 8 applications (8 gallons EC/A) per plant crop and 5 applications (5 gallons EC/A) per ratoon crop)
- Potato (12 lbs. ai/A; within 2 weeks prior to or at planting or until prior to crop emergence, one application per crop)
- Sugarcane (8 lbs. ai/A; at planting, one application per crop)
- Sweet Potato (8 lbs. ai/A; 2-3 weeks before planting, one application per crop)
- Tobacco (12 lbs. ai/A; from 1 to 2 weeks prior to transplanting time to transplanting time, one application per crop)

ii. Summary of Toxicity Concerns Impacting Occupational Exposures

Acute Toxicology Categories

Guideline studies for acute toxicity indicate that the technical grade of ethoprop is classified as category I for acute oral and acute dermal toxicity, category II for acute inhalation toxicity, and category I for primary eye irritation and primary skin irritation. There are no data on dermal sensitization; the 1988 Reregistration Standard waived this data requirement due to mortality during primary skin irritation tests.[5]

Other Endpoints of Concern

Dermal Exposure

For the short-term and intermediate-term dermal occupational exposure scenarios a NOEL of 0.1 mg/kg/day will be used for calculating the MOE. Since the NOEL is from a dermal study, no dermal absorption adjustment is required for these assessments. A MOE of 100 is considered appropriate. A 70 kg body weight will be used in the calculation.

Total Exposure (Dermal and Inhalation Exposure)

An inhalation NOEL could not be identified. Thus, to consider inhalation exposure, the dermal and inhalation exposures will be added together and a NOEL of 0.025 mg/kg/day derived from a feeding study will be used for calculating the MOE. Since the NOEL is from an oral (dietary) study, the dermal and inhalation exposures should be converted to oral-equivalents. In the absence of either a dermal or inhalation absorption factor, a value of 100 percent is assumed for both the dermal and inhalation exposure components in this risk assessment. A MOE of 100 is considered appropriate. A 70 kg body weight will be used in the calculation.

A NOEL of 0.01 mg/kg/day has been identified for the chronic exposure scenario. Since the NOEL is from an oral (dietary) study, the dermal and inhalation exposures should be converted to oral-equivalents. In the absence of either a dermal or inhalation absorption factor, a value of 100 percent is assumed for both the dermal and inhalation exposure components in this risk assessment. A MOE of 100 is considered appropriate. A 70 kg body weight will be used in the calculation. However, during the exposure assessment process, the exposures which would result from the uses of ethoprop were determined to be of an intermittent nature. The frequency and duration of these exposures do not exhibit a chronic exposure pattern. The exposures do not occur often enough to be considered a chronic exposure, i.e. a continuous exposure that occurs for at least several months. Therefore, performing a chronic occupational assessment is not appropriate.

Ethoprop was determined to be a likely carcinogen. The cancer potency value or Q_1* is 2.81 E-02 $(mg/kg/day)^{-1}$ for ethoprop. In the absence of either a dermal or inhalation absorption factor, a value of 100 percent is assumed for both the dermal and inhalation exposure components in this risk assessment. A 70 kg body weight will be used in the calculation.

Epidemiological Information

See Attachment 2 for March 9, 1988 Jerome Blondell memo - Review of Ethoprop Incident Reports

iii. Handler Exposure Scenarios & Assumptions

HED has determined that handlers (i.e. mixers, loaders, applicators, flaggers) are likely to be exposed during ethoprop use. The anticipated use-patterns and current labeling indicate several major exposure scenarios based on the types of equipment that potentially can be used to make ethoprop applications. These scenarios include:

1a • loading granulars for aerial application;
1b • loading granulars for tractor-drawn spreader application;
2a • mixing/loading liquids for chemigation application;
2b • mixing/loading liquids for groundboom application;
3a • applying granulars with fixed-wing aircraft;
3b • applying granulars with a tractor-drawn spreader;

4 • applying sprays with a groundboom sprayer;
5a • loading/applying granules with a push-type granular spreader;
5b • loading/applying granules by hand;
6a • mixing/loading/applying sprays with a low pressure handwand;
6b • mixing/loading/applying sprays with a backpack sprayer;
7 • mixing/loading/applying liquids with a sprinkler can;
8 • mixing/loading/applying liquid concentrate by handheld measuring container; and
9 • dipping in liquid formulations; and
10 • flagging granular application with fixed-wing aircraft.

Exposure data from the PHED Version 1.1 garden hose-end sprayer scenario are used as surrogate data for the sprinkler can scenario. There are neither exposure data nor pesticide application information available for scenarios 8 and 9. These scenarios are referenced in the following Tables as No Data.

iv. Occupational Handler Exposures

Background

Baseline dermal and inhalation exposure values (developed using PHED Version 1.1 surrogate data) are presented in Table 1. Table 2 presents the risk assessment for the dermal exposure for the short-term and intermediate-term scenarios. Table 2 includes increasing mitigation measures (PPE and engineering controls). Tables 3 and 4 present the risk assessment for the total exposure (dermal and inhalation) for the short-term and intermediate-term scenarios. Table 3 includes increasing mitigation measures (PPE), and Table 4 includes increasing mitigation measures (engineering controls). Tables 5 and 6 present the cancer risks. Table 7 summarizes the caveats and parameters specific to each exposure scenario and corresponding risk assessment.

The following assumptions and factors were used in order to complete this exposure assessment:

- Average body weight of an adult handler is 70 kg.

- Average work day interval represents an 8 hour workday (e.g., the acres treated on a typical day).

- Daily area treated in each scenario include:

Granules by fixed-wing aircraft:	-potatoes - 350 acres
Granules by tractor-drawn spreader:	-agricultural - 80 acres
	-golf-course turf - 40 acres
Granules by hand (banana/plantain):	-agricultural - 1 acre
Granules by push-type spreader to turf:	-golf course turf - 8 acres

Liquids by chemigation:	-agricultural - 350 or -agricultural - 80 acres
Liquids by groundboom spray:	-agricultural - 80 acres
Liquids by low-pressure handwand:	-agricultural - 5 acres
Liquids by backpack sprayer:	-agricultural - 5 acres
Liquids with sprinkler can:	-agricultural - 1 acre

These values are believed to represent typical to reasonable high-end estimates of daily area treated.

- To bracket risk levels associated with the various use patterns, calculations were performed for a range of application rates to agricultural crops (i.e., low-range, mid-range and high range), and the maximum application rate to golf-course turf) as listed on current ethoprop labels. (Note that the application rates vary depending on the crop. No use data were provided by the registrant concerning the actual or typical application rates that may be commonly used for ethoprop.

- Due to a lack of scenario-specific data, HED estimated unit exposure values using generic protection factors that are applied to represent various risk mitigation options (i.e., the use of personal protective equipment and engineering controls). When protection factors are used in estimating exposure, it is noted in footnotes. Table 7 summarizes the caveats and parameters specific to the PHED data used for each exposure scenario and corresponding exposure/risk assessment.

- For the cancer assessment, the number of days worked per year (i.e., exposure frequency) was assumed to be equivalent to the number of applications per season, representing typical exposures experienced by growers who apply ethoprop to their fields, or ten times the number of applications per season, representing typical exposures experienced by commercial handlers.

- It was also assumed that workers are exposed for 35 years over a 70 year lifetime.

Handler Exposure Assessment

No chemical-specific handler exposure data were submitted in support of the reregistration of ethoprop. Therefore, an exposure assessment for each use scenario was developed, where appropriate data are available, using surrogate values calculated using the *Pesticide Handlers Exposure Database (PHED) Version 1.1.*

Dermal and inhalation exposures are presented in Table 1. No chemical-specific data were submitted; therefore, Table 1 was developed using PHED Version 1.1 surrogate data. The Pesticide Handlers Exposure Database (PHED) was developed by Health Canada, the American Crop Protection Association, and EPA. PHED was initially released for public use in 1992.

PHED is a comprehensive generic/surrogate exposure database containing a large number of measured values of dermal and inhalation exposure for pesticide workers (e.g., mixers, loaders, and applicators) involved in the handling or application of pesticides in the field. The database currently contains data for over 2000 monitored exposure events. Use of surrogate or generic data is appropriate since it is generally believed that the physical parameters of the handling and application process (e.g. the type of formulations, the method of application, and the type of clothing), not the chemical properties of the pesticide, control the amount of dermal and inhalation exposure. Thus, PHED typically allows exposure and risk assessments to be conducted with a much larger number of observations than available from a single exposure study.

PHED also contains algorithms that allow the user to complete surrogate task-based exposure assessments beginning with one of the four main data files contained in the system (i.e., mixer/loader, applicator, flagger, and mixer/loader/applicator). Users select data from each file and construct exposure scenarios that are representative of the use of the chemical. HED, in conjunction with the PHED task force, has evaluated all of the data currently in PHED, and developed a surrogate exposure table that contains a series of standard exposure estimates for various scenarios. These standard unit exposure values are the basis for this assessment. The standard exposure values (i.e., the unit exposure values included in the exposure and risk assessment tables) are based on the "best fit" values calculated by PHED. PHED calculates "best fit" exposure values by assessing the distributions of exposures for each body part included in datasets selected for the assessment (e.g., chest or forearm) and then calculating a composite exposure value representing the entire body. PHED categorizes distributions as normal, lognormal, or in an "other" category. Generally, most data contained in PHED are lognormally distributed or fall into the PHED "other" distribution category. If the distribution is lognormal, the geometric mean for the distribution is used in the calculation of the "best fit" exposure value. If the data are an "other" distribution, the median value of the dataset is used in the calculation of the "best fit" exposure value. As a result, the surrogate unit exposure values that serve as the basis for this assessment generally range from the geometric mean to the median of the selected dataset.

HED's first step in performing a handler exposure assessment is to complete a baseline exposure assessment. The baseline scenario generally represents a handler wearing long pants, a long-sleeved shirt, and no chemical-resistant gloves. Table 1 exposure estimates are baseline estimates. If, there is a level of concern, then increasing levels of risk mitigation, such as PPE (personal protective equipment) and engineering controls, are then used in an attempt to achieve an appropriate margin of exposure or cancer risk.

The following calculations are used in this assessment:

Dermal Exposure

The calculations of daily dermal exposure to ethoprop by handlers are used to calculate the daily dose, and hence the risks, to those handlers. Potential daily dermal exposure is calculated using the following formula:

Daily dermal exposure (mg ai/day) =
Unit exposure (mg ai/lb ai) x Application Rate (lb ai/A) x Daily Acres Treated (A/day).

Inhalation Exposure

The calculations of daily inhalation exposure to ethoprop by handlers are used to calculate the daily dose, and hence the risks, to those handlers. Daily inhalation exposure levels were calculated for inclusion into the PHED surrogate exposure tables and presented as (μg/lb ai) based on a human inhalation rate of 29 L/minute and an 8 hour working day.

Potential inhalation daily exposure was calculated using the following formulas:

Daily inhalation exposure (mg ai/day) =
[Unit exposure (μg ai/lb ai)/1,000 μg/mg unit conversion] x Application Rate (lb ai/A) x Daily Acres Treated (A/day).

Total Exposure

For those calculations for which appropriate, the total daily exposure is obtained by summing the daily dermal exposure and the daily inhalation exposure.

Daily Potential Dose

The calculation of daily dose (whether dermal, inhalation or total) is based on the following formula:

Daily dose (mg/kg/day) = Daily exposure (mg/day) / Body weight (70 kg).

The lifetime average daily dose (LADD) used in the cancer risk assessment was calculated using the following formula:

LADD (mg/kg/day) =
Daily Total Dose (mg/kg/day) * (frequency of exposure)

where: Daily Total Dose (mg/kg/day) =
[Daily Dermal Dose (mg/kg/day)] + Daily Inhalation Dose (mg/kg/day)

frequency of exposure = (days worked/365 days per year) * (35 years worked/70 year lifetime)

Risk for the short-term and intermediate term scenarios was calculated using the following formula:

MOE = NOEL (mg/kg/day)/Daily Dose (mg/kg/day)

The cancer risk was calculated using the following formula:

$$\text{Risk} = \text{LADD (mg/kg/day)} * Q_1^* \text{ (mg/kg/day)}^{-1}$$

Table 1 Baseline Dermal and Inhalation Exposure to Ethoprop

Exposure Scenario (Scen.#)	Baseline Dermal Unit Exposure [a] (mg/lb ai)	Baseline Inhalation Unit Exposure [b] (ug/lb ai)	Range of Maximum Application Rates & Crop Type[c,d] (lb ai/Acre)	Daily Acres Treated[e] (Acres/day)	Daily Dermal Exposure[f] (mg/day)	Daily Inhalation Exposure[g] (mg/day)	Baseline Total Daily Exposure (mg/day)
I. Mixer/Loaders (Scenario No.)							
Loading Granulars for Application by Fixed-wing Aircraft **(1a)**	0.0076	1.7	Ag - 6 (low)	350	16	3.6	20
			Ag - 12 (high)	350	32	7.1	39
Loading Granulars for Application with a Tractor-drawn Mechanical Spreader **(1b)**			Ag - 2 (low)	80	1.2	0.27	1.5
			Ag - 6 (med)	80	3.6	0.82	4.4
			Ag - 12 (high)	80	7.3	1.6	8.9
			Turf - 20	40	6.1	1.4	7.5
Mixing/Loading Liquids for Chemigation **(2a)**	2.9	1.2	Ag - 2 (low)	350	2,000	0.84	2,000
			Ag - 6 (med)	350	6,100	2.5	6,100
			Ag - 12 (high)	350	12,000	5.0	12,000
			Ag - 2 (low)	80	460	0.19	460
			Ag - 6 (med)	80	1,400	0.58	1,400
			Ag - 12 (high)	80	2,800	1.2	2,800
Mixing/Loading Liquids for Groundboom Application **(2b)**			Ag - 2 (low)	80	460	0.19	460
			Ag- 6 (med)	80	1,400	0.58	1,400
			Ag- 12 (high)	80	2,800	1.2	2,800
II. Applicator (Scenario No.)							
Applying Granulars with Fixed-Wing Aircraft **(3a)**	see Engineering Controls	see Engineering Controls	Ag- 6 (low)	350	------	------	------
			Ag- 12 (high)	350	------	------	------

Table 1 Baseline Dermal and Inhalation Exposure to Ethoprop

Exposure Scenario (Scen.#)	Baseline Dermal Unit Exposure [a] (mg/lb ai)	Baseline Inhalation Unit Exposure [b] (ug/lb ai)	Range of Maximum Application Rates & Crop Type[c,d] (lb ai/Acre)	Daily Acres Treated[e] (Acres/day)	Daily Dermal Exposure[f] (mg/day)	Daily Inhalation Exposure[g] (mg/day)	Baseline Total Daily Exposure (mg/day)
Applying Granulars with a Tractor-drawn Mechanical Spreader **(3b)**	0.0099	1.2	Ag - 2 (low)	80	1.6	0.19	1.8
			Ag- 6 (med)	80	4.8	0.58	5.4
			Ag- 12 (high)	80	9.6	1.2	11
			Turf - 20	40	8.0	0.96	9.0
Applying Sprays with a Groundboom Sprayer **(4)**	0.015	0.70	Ag - 2 (low)	80	2.4	0.11	2.5
			Ag- 6 (med)	80	7.2	0.34	7.5
			Ag - 12 (high)	80	14	0.67	15
III. Mixer/Loader/Applicators (Scenario No.)							
Loading/Applying Granulars with a Push-type Granular Spreader **(5a)**	2.9	6.3	Turf - 20	8	460	1.0	460
Loading/Applying Granulars by Hand **(5b)**	100	470	Ag -26 banana; plantain	1	2600	12	2600
Mixing/Loading/Applying Liquids with a Low-pressure Handwand Sprayer **(6a**)	100	31	Ag - 5 (non-bearing citrus trunks)	8	4000	1.2	4000
Mixing/Loading/Applying Liquids with a Backpack Sprayer **(6b**)	2.6	30	Ag - 5 (non-bearing citrus trunks)	8	100	1.2	100
Mixing/Loading/Applying Liquids with a Sprinkler Can **(7)**[h]	31	9.5	Ag - (low) 3	1	93	0.029	93
			Ag - (high) 6	1	190	0.057	190
Mixing/Loading/Applying Liquid Concentrate by Handheld Measuring Container **(8)**	No data	No data	Ag - 26 banana; plantain	No data	------	-----	-----
Dipping in Liquids **(9)**	No data	No data	0.0075 lb/gal citrus seedlings	No data	-----	------	-----

Table 1 Baseline Dermal and Inhalation Exposure to Ethoprop

Exposure Scenario (Scen.#)	Baseline Dermal Unit Exposure [a] (mg/lb ai)	Baseline Inhalation Unit Exposure [b] (ug/lb ai)	Range of Maximum Application Rates & Crop Type[c,d] (lb ai/Acre)	Daily Acres Treated[e] (Acres/day)	Daily Dermal Exposure[f] (mg/day)	Daily Inhalation Exposure[g] (mg/day)	Baseline Total Daily Exposure (mg/day)
IV. Flaggers (Scenario No.)							
Flagging Granular Applications with Fixed Wing Aircraft **(10)**	0.0025	0.15	Ag - (low) 6	350	5.3	0.32	5.6
			Ag - (high) 12	350	11	0.63	12

Footnotes

a Baseline dermal unit exposures represent long pants, long sleeved shirt, no gloves, open mixing/loading, and open cab tractors, as appropriate. The only exception is for exposure scenario #6b (i.e., Mixing/Loading/Applying Liquid Formulation with a Backpack Sprayer) where the PHED unit exposure value includes the use of protective gloves (i.e., it is not appropriate to calculate non-gloved exposures based on values at the LOQ, which is the case for this scenario).

b Baseline inhalation unit exposures reflect no respiratory protection.

c Application rates represent the low, mid-range (med), and high maximum application rates found on ethoprop labels for agricultural crops, plus the highest application rate for turf applications, where appropriate.

d Crop Type or Target provides a general description of the intended uses of various products containing ethoprop. Separate categories are presented because of the distinct differences in application rates and acres treated. *Ag* = agricultural crops and *Turf* = golf-course turf. Sod farm uses have been canceled.

e Values for "Daily acres treated" are from EPA estimates of acreage that could be treated in a single day for each exposure scenario of concern based on the application method.

f Daily Dermal Exposure (mg/day) = Exposure (mg/lb ai) * Application Rate (lb ai/acre) * Acres Treated/Day

g Daily Inhalation Exposure (mg/day) = Exposure (µg/lb ai) x (1 mg/1000 µg) Conversion x Application Rate (lb ai/acre) x Acres Treated/Day

h PHED garden hose-end sprayer scenario values used as surrogate values for sprinkler can scenario

Table 2: Dermal Exposure
Short-Term and Intermediate-Term Risk From Ethoprop
Baseline, PPE, and Engineering Controls

Exposure Scenario (Scen #)	Range of Maximum Application Rates and Crop Type (lb ai/Acre)	Baseline Daily Dermal Dose (mg/kg/day)[a]	Baseline Dermal MOE[b]	Risk Mitigation Measures					
				PPE - Dermal [d]			Engineering Controls - Dermal		
				PPE Dermal Unit Exposure (mg/lb. ai)	PPE Daily Dermal Dose[c,a] (mg/kg/day)	PPE Dermal MOE[b]	Eng. Controls Dermal Unit Exposure (mg/lb. ai)	Eng. Controls Daily Dermal Dose[c,a] (mg/kg/day)	Eng. Controls Dermal MOE[b]
I. Mixer/Loader Risk									
Loading Granulars for Application by Fixed Wing Aircraft **(1a)**	Ag - 6 (low)	0.23	<1	0.0043	0.13	1	0.00015	0.0045	22
	Ag - 12 (high)	0.46	<1		0.26	<1		0.0090	11
Loading Granulars for Application with a Tractor-drawn Spreader **(1b)**	Ag - 2 (low)	0.017	6	0.0043	0.0098	10	0.00015	0.00034	290
	Ag - 6 (med)	0.051	2		0.029	3		0.0010	100
	Ag - 12 (high)	0.10	1		0.059	2		0.0021	48
	Turf - 20	0.087	1		0.049	2		0.0017	59
Mixing/Loading Liquid Formulation for Chemigation **(2a)**	Ag - 2 (low)	29	<1	0.025	0.25	<1	0.009	0.090	1
	Ag - 6 (med)	87	<1		0.75	<1		0.27	<1
	Ag - 12 (high)	170	<1		1.5	<1		0.54	<1
	Ag - 2 (low)	6.6	<1		0.057	2		0.021	5
	Ag - 6 (med)	20	<1		0.17	1		0.062	2
	Ag - 12 (high)	40	<1		0.34	<1		0.12	1
Mixing/Loading Liquid Formulation for Groundboom Applications **(2b)**	Ag - 2 (low)	6.6	<1	0.025	0.057	2	0.009	0.021	5
	Ag- 6 (med)	20	<1		0.17	1		0.062	2
	Ag- 12 (high)	40	<1		0.34	<1		0.12	1
II. Applicator Risk									
Applying Granulars with Fixed-wing Aircraft **(3a)**	Ag- 6 (low)	See Eng. Controls.	-------	See Eng. Controls.	-------	-------	0.0016	0.048	2
	Ag- 12 (high)		-------		-------	-------		0.096	1
Applying Granulars with a Tractor-Drawn Mechanical Spreader **(3b)**	Ag - 2 (low)	0.023	4	0.0038	0.0087	12	0.0022	0.0050	20
	Ag- 6 (med)	0.069	2		0.026	4		0.015	7
	Ag- 12 (high)	0.14	1		0.052	2		0.030	3

Table 2: Dermal Exposure
Short-Term and Intermediate-Term Risk From Ethoprop
Baseline, PPE, and Engineering Controls

	Turf - 20	0.11	1		0.043	2		0.025	4
Applying Sprays with a Groundboom Sprayer **(4)**	Ag - 2 (low)	0.034	3	0.01	0.023	4	0.0067	0.015	7
	Ag - 6 (med)	0.10	1		0.069	2		0.046	2
	Ag - 12 (high)	0.20	1		0.14	1		0.092	1
III. Mixer /Loader /Applicator Risk									
Loading/Applying Granulars with Push-type Granular Spreader **(5a)**	Turf - 20	6.6	<1	0.73	1.7	<1	No Engineering Controls[g]	-----	-----
Loading/Applying Granulars by Hand **(5b)**	Ag - 26 banana; plantain	37	< 1	38	14	< 1	No Engineering Controls[g]	-----	-----
Mixing/Loading/Applying Liquid Formulation with a Low Pressure Handwand Sprayer **(6a)**	Ag - 5 (non-bearing citrus trunks)	57	<1	3.2	1.8	<1	No Engineering Controls[g]	-----	-----
Mixing/Loading/Applying Liquid Formulation with a Backpack Sprayer **(6b)**	Ag - 5 (non-bearing citrus trunks)	1.4	<1	1.3	0.74	<1	No Engineering Controls[g]	-----	-----
Mixing/Loading/Applying Liquid Formulation with a Sprinkler Can **(7)**	Ag - 3 (low)	1.3	<1	4.3	0.18	1	No Engineering Controls[g]	-----	-----
	Ag - 6 (high)	2.7	<1		0.37	<1	No Engineering Controls[g]	-----	-----
Mixing/Loading/ Applying Concentrate **(8)**	Ag - 6 banana; plantain	No data[e]	----------	No data	----------	----------	-----	-----	-----
Dipping in Liquid Formulation **(9)**	0.0075 lb/gal citrus seedlings	No data	----------	No data	----------	----------	-----	-----	-----
IV. Flagger Risk									
Flagging Granular Application with Fixed-Wing Aircraft **(10)**	Ag - 6 (low)	0.076	1	0.0013	0.039	3	0.0022	0.066	2
	Ag - 12 (high)	0.16	1		0.078	1		0.13	1

Footnotes

a Daily Dermal Dose (mg/kg/day) = (Daily Dermal Exposure (mg/day)/ Body weight (70 kg)).
b Dermal MOE = (NOEL (0.1 mg/kg/day)/ Daily Dermal Dose (mg/kg/day)).
c Daily Dermal Exposure (mg/day) = dermal unit exposure (mg/lb ai)*application rate (lb ai/acre)* acres treated/day
For acres treated per day see Table 1

d Additional PPE:

1a/1b:	Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer)
2a/2b:	Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer)
3a/3b:	Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer)
4:	Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer)
5a/b:	Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer)
6a:	Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer)
6b:	Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer)
7:	Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer)
8:	Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer)
9:	Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer)
10:	Double layer of clothing without gloves (50 % PF for clothing layer)

e No data No data in PHED for this scenario

f Engineering Controls:

1a/1b:	Assume use of a Lock n' Load product - For dermal a 90% protection factor (PF) is applied to all baseline dermal exposure; for inhalation a 90% PF is applied to baseline inhalation exposure
2a/2b:	Mechanical Transfer or Gel-Tec water soluble packaging; single layer clothing, and chemical resistant gloves
3a:	Enclosed cockpit; single layer clothing
3b:	Enclosed tractor cab; single layer clothing
4:	Enclosed tractor cab: single layer clothing
10:	Enclosed cab: single layer clothing

g No engineering controls are available for this scenario.

Table 3: Dermal and Inhalation Exposure
Short-Term and Intermediate-Term Risk From Ethoprop
Baseline and With Additional PPE

Exposure Scenario (Scen #)	Range of maximum Application rates and Crop Type (lb ai/acre)	Baseline Daily Dermal Dose (mg/kg/day)[a]	Baseline Daily Inhalation Dose (mg/kg/day)[c]	Baseline Daily Total Dose (mg/kg/day)[d]	Baseline Total MOE[e]	Risk Mitigation Measures - Additional Personal Protective Equipment[g]					
						PPE - Dermal		PPE - Inhalation		PPE - Total	
						PPE Dermal Unit Exposure (mg/lb. ai)	PPE Daily Dermal Dose[a] (mg/kg/day)	PPE Inhalation Unit Exposure (ug/lb. ai)	PPE Daily Inhalation Dose[c] (mg/kg/day)	PPE Daily Total Dose[d] (mg/kg/day)	PPE Total MOE[e]
I. Mixer/Loader Risk											
Loading Granular for Application by Fixed Wing Aircraft **(1a)**	Ag - 6 (low)	0.23	0.051	0.29	<1	0.0043	0.13	0.17	0.0051	0.14	<1
	Ag 12 (high)	0.46	0.10	0.56	<1		0.26		0.010	0.27	<1
Loading Granular for Application with a Tractor-drawn Spreader **(1b)**	Ag - 2 (low)	0.017	0.0039	0.021	1	0.0043	0.0098	0.17	0.00039	0.010	3
	Ag - 6 (med)	0.051	0.012	0.063	<1		0.029		0.0012	0.030	1
	Ag - 12 (high)	0.10	0.023	0.13	<1		0.059		0.0023	0.061	<1
	Turf - 20	0.087	0.020	0.11	<1		0.049		0.0019	0.051	<1
Mixing/Loading Liquid Formulation for Chemigation **(2a)**	Ag - 2 (low)	29	0.012	29	<1	0.025	0.25	0.12	0.0012	0.25	<1
	Ag - 6 (med)	87	0.036	87	<1		0.75		0.0036	0.75	<1
	Ag - 12 (high)	170	0.073	170	<1		1.5		0.0072	1.5	<1
	Ag - 2 (low)	6.6	0.0027	6.6	<1		0.057		0.00027	0.057	<1
	Ag - 6 (med)	20	0.0083	20	<1		0.17		0.00082	0.17	<1
	Ag - 12 (high)	40	0.017	40	<1		0.34		0.0016	0.34	<1
Mixing/Loading Liquid Formulation for Groundboom Applications **(2b)**	Ag - 2 (low)	6.6	0.0027	6.6	<1	0.025	0.057	0.12	0.00027	0.057	<1
	Ag - 6 (med)	20	0.0083	20	<1		0.17		0.00082	0.17	<1
	Ag - 12 (high)	40	0.017	40	<1		0.34		0.0016	0.34	<1
II. Applicator Risk											
Applying Granular with Fixed-wing Aircraft **(3a)**	Ag - 6 (low)	See Eng. Controls.	-------	-------	-------	See Eng. Controls.	-------	-------	-------	-------	-------
	Ag - 12 (high)		-------	-------	-------		-------	-------	-------	-------	-------
Applying Granular with a Tractor-Drawn Mechanical Spreader **(3b)**	Ag - 2 (low)	0.023	0.0027	0.026	1	0.0038	0.0087	0.12	0.00027	0.0090	3
	Ag - 6 (med)	0.069	0.0083	0.077	<1		0.026		0.00082	0.027	1
	Ag - 12 (high)	0.14	0.017	0.16	<1		0.052		0.0016	0.054	<1
	Turf - 20	0.11	0.014	0.13	<1		0.043		0.0014	0.045	1

Table 3: Dermal and Inhalation Exposure
Short-Term and Intermediate-Term Risk From Ethoprop
Baseline and With Additional PPE

Exposure Scenario (Scen #)	Range of maximum Application rates and Crop Type (lb ai/acre)	Baseline Daily Dermal Dose (mg/kg/day)[a]	Baseline Daily Inhalation Dose (mg/kg/day)[c]	Baseline Daily Total Dose (mg/kg/day)[d]	Baseline Total MOE[e]	Risk Mitigation Measures - Additional Personal Protective Equipment[g]					
						PPE - Dermal		PPE - Inhalation		PPE - Total	
						PPE Dermal Unit Exposure (mg/lb. ai)	PPE Daily Dermal Dose[a] (mg/kg/day)	PPE Inhalation Unit Exposure (ug/lb. ai)	PPE Daily Inhalation Dose[c] (mg/kg/day)	PPE Daily Total Dose[d] (mg/kg/day)	PPE Total MOE[e]
Applying Sprays with a Groundboom Sprayer **(4)**	Ag - 2 (low)	0.034	0.0016	0.036	1	0.01	0.023	0.07	0.00016	0.023	1
	Ag - 6 (med)	0.10	0.0049	0.11	<1		0.069		0.00048	0.069	<1
	Ag - 12 (high)	0.20	0.0096	0.21	<1		0.14		0.00096	0.14	<1
III. Mixer /Loader /Applicator Risk											
Loading/Applying Granular with Push-type Granular Spreader **(5a)**	Turf - 20	6.6	0.014	6.6	<1	0.73	1.7	0.63	0.0014	1.7	<1
Loading/Applying Granular by Hand **(5b)**	Ag - 26 banana; plantain	37	0.17	37	< 1	38	14	47	0.017	14	<1
Mixing/Loading/Applying Liquid Formulation with a Low Pressure Handwand Sprayer **(6a)**	Ag 5 (non-bearing citrus trunks)	57	0.017	57	<1	3.2	1.8	3.1	0.0018	1.8	<1
Mixing/Loading/Applying Liquid Formulation with a Backpack Sprayer **(6b)**	Ag 5 (non-bearing citrus trunks)	1.4	0.017	1.4	<1	1.3	0.74	3.0	0.0017	0.74	<1
Mixing/Loading/Applying Liquid Formulation with a Sprinkler Can **(7)**	Ag - 3 (low)	1.3	0.00041	1.3	<1	4.3	0.18	0.95	0.000041	0.18	<1
	Ag - 6 (high)	2.7	0.00081	2.7	<1		0.37		0.000081	0.37	<1
Mixing/Loading/ Applying Concentrate **(8)**	Ag - 26 banana; plantain	No data[f]	No data	----------	----------	No data	----------	No data	----------	----------	--------
Dipping in Liquid Formulation **(9)**	0.0075 lb/gal citrus seedlings	No data	No data	----------	----------	No data	----------	No data	----------	----------	--------

Table 3: Dermal and Inhalation Exposure
Short-Term and Intermediate-Term Risk From Ethoprop
Baseline and With Additional PPE

Exposure Scenario (Scen #)	Range of maximum Application rates and Crop Type (lb ai/acre)	Baseline Daily Dermal Dose (mg/kg/day)[a]	Baseline Daily Inhalation Dose (mg/kg/day)[c]	Baseline Daily Total Dose (mg/kg/day)[d]	Baseline Total MOE[e]	Risk Mitigation Measures - Additional Personal Protective Equipment[g]					
						PPE - Dermal		PPE - Inhalation		PPE - Total	
						PPE Dermal Unit Exposure (mg/lb. ai)	PPE Daily Dermal Dose[a] (mg/kg/day)	PPE Inhalation Unit Exposure (ug/lb. ai)	PPE Daily Inhalation Dose[c] (mg/kg/day)	PPE Daily Total Dose[d] (mg/kg/day)	PPE Total MOE[e]
IV. Flagger Risk											
Flagging Granular Application with Fixed-Wing Aircraft **(10)**	Ag - 6 (low)	0.076	0.0046	0.080	<1	0.0013	0.039	0.015	0.00045	0.039	1
	Ag - 12 (high)	0.16	0.0090	0.17	<1		0.078		0.00090	0.079	<1

Footnotes

a Daily Dermal Dose (mg/kg/day) = (Daily Dermal Exposure (mg/day)/ Body weight (70 kg)).
b Daily Inhalation Dose (mg/kg/day) = [(Daily Inhalation Exposure (ug/day)/1000 ug/mg)] / (Body weight (70 kg)).
c Daily Total Dose (mg/kg/day) = (Daily Dermal Dose (mg/kg/day)) + (Daily Inhalation Dose (mg/kg/day)).
d Total MOE = (NOEL (0.025 mg/kg/day)/ Daily Total Dose (mg/kg/day)).
e Daily Dermal Exposure (mg/day) = dermal unit exposure (mg/lb ai)*application rate (lb ai/acre)* acres treated/day
For acres treated per day see Table 1
f No data No data in PHED for this scenario
g Additional PPE:
1a/1b: Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer); 90% respiratory protection factor.
2a/2b: Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer); 90% respiratory protection factor.
3a/3b: Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer); 90% respiratory protection factor.
4: Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer); 90% respiratory protection factor.
5a/b: Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer); 90% respiratory protection factor.
6a: Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer); 90% respiratory protection factor.
6b: Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer); 90% respiratory protection factor.
7: Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer); 90% respiratory protection factor.
8: Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer); 90% respiratory protection factor.
9: Double layer of clothing and chemical resistant gloves (50 % PF for clothing layer); 90% respiratory protection factor.
10: Double layer of clothing without gloves (50 % PF for clothing layer); 90% respiratory protection factor.

Table 4: Dermal and Inhaltion Exposure
Short-Term and Intermediate-Term Risk From Ethoprop
Engineering Controls

Exposure Scenario (Scen #)	Range of Maximum Application Rates and Crop Type (lb ai/acre)	Risk Mitigation Measures - Engineering Controls[f]					
		Eng. Controls - Dermal		Eng. Controls - Inhalation		Eng. Controls - Total	
		Eng. Controls Dermal Unit Exposure (mg/lb. ai)	Eng. Controls Daily Dermal Dose[a] (mg/kg/day)	Eng. Controls Inhalation Unit Exposure (ug/lb. ai)	Eng. Controls Daily Inhalation Dose[b] (mg/kg/day)	Eng. Controls Daily Total Dose[c] (mg/kg/day)	Eng. Controls Total MOE[d]
I. Mixer/Loader Risks							
Loading Granular for Application by Fixed-Wing Aircraft **(1a)**	Ag - 6 (low)	0.00076	0.023	0.17	0.0051	0.028	< 1
	Ag - 12 (high)		0.046		0.010	0.056	< 1
Loading Granular for Application with a Tractor-drawn Mechanical Spreader **(1b)**	Ag - 2 (low)	0.00076	0.0017	0.17	0.00039	0.0056	4
	Ag - 6 (med)		0.0052		0.0012	0.0064	4
	Ag - 12 (high)		0.010		0.0023	0.012	2
	Turf - 20		0.0089		0.0019	0.011	2
Mixing/Loading Liquid Formulation for Chemigation **(2a)**	Ag - 2 (low)	0.009	0.090	0.08	0.00080	0.091	<1
	Ag - 6 (med)		0.27		0.0024	0.27	<1
	Ag - 12 (high)		0.54		0.0048	0.54	<1
	Ag - 2 (low)		0.021		0.00018	0.021	1
	Ag - 6 (med)		0.062		0.00055	0.063	<1
	Ag - 12 (high)		0.12		0.0011	0.12	<1
Mixing/Loading Liquid Formulation for Groundboom Application **(2b)**	Ag - 2 (low)	0.009	0.021	0.08	0.00018	0.021	1
	Ag - 6 (med)		0.062		0.00055	0.063	<1
	Ag - 12 (high)		0.12		0.0011	0.12	<1

Table 4: Dermal and Inhaltion Exposure
Short-Term and Intermediate-Term Risk From Ethoprop
Engineering Controls

Exposure Scenario (Scen #)	Range of Maximum Application Rates and Crop Type (lb ai/acre)	Risk Mitigation Measures - Engineering Controls[f]					
		Eng. Controls - Dermal		Eng. Controls - Inhalation		Eng. Controls - Total	
		Eng. Controls Dermal Unit Exposure (mg/lb. ai)	Eng. Controls Daily Dermal Dose[a] (mg/kg/day)	Eng. Controls Inhalation Unit Exposure (ug/lb. ai)	Eng. Controls Daily Inhalation Dose[b] (mg/kg/day)	Eng. Controls Daily Total Dose[c] (mg/kg/day)	Eng. Controls Total MOE[d]
II. Applicator Risks							
Applying Granular with Fixed-wing Aircraft **(3a)**	Ag - 6 (low)	0.00044	0.013	0.13	0.0039	0.017	3
	Ag - 12 (high)		0.026		0.0078	0.034	<1
Applying Granular with a Tractor-Drawn Mechanical Spreader **(3b)**	Ag - 2 (low)	0.0021	0.0050	0.22	0.00050	0.0055	5
	Ag - 6 (med)		0.015		0.0015	0.017	1
	Ag - 12 (high)		0.030		0.0030	0.033	< 1
	Turf - 20		0.025		0.0025	0.028	< 1
Applying Sprays with a Groundboom Sprayer **(4)**	Ag - 2 (low)	0.0067	0.015	0.043	0.000098	0.015	2
	Ag - 6 (med)		0.046		0.00029	0.046	1
	Ag - 12 (high)		0.092		0.00059	0.093	<1
III. Mixer/Loader/Applicator Risks							
Loading/Applying Granules with Push-type Granular Spreader **(5a)**	-----	No Engineering Controls[e]	-----	No Engineering Controls[e]	-----	-----	-----
Loading/Applying Granules by Hand **(5b)**	-----	No Engineering Controls[e]	-----	No Engineering Controls[e]	-----	-----	-----
Mixing/Loading/Applying Liquid Formulation with a Low Pressure Handwand Sprayer **(6a)**	-----	No Engineering Controls[e]	-----	No Engineering Controls[e]	-----	-----	-----

Table 4: Dermal and Inhaltion Exposure
Short-Term and Intermediate-Term Risk From Ethoprop
Engineering Controls

Exposure Scenario (Scen #)	Range of Maximum Application Rates and Crop Type (lb ai/acre)	Risk Mitigation Measures - Engineering Controls[f]					
		Eng. Controls - Dermal		Eng. Controls - Inhalation		Eng. Controls - Total	
		Eng. Controls Dermal Unit Exposure (mg/lb. ai)	Eng. Controls Daily Dermal Dose[a] (mg/kg/day)	Eng. Controls Inhalation Unit Exposure (ug/lb. ai)	Eng. Controls Daily Inhalation Dose[b] (mg/kg/day)	Eng. Controls Daily Total Dose[c] (mg/kg/day)	Eng. Controls Total MOE[d]
Mixing/Loading/Applying Liquid Formulation with a Backpack Sprayer **(6b)**	-----	No Engineering Controls[e]	-----	No Engineering Controls[e]	-----	-----	-----
Mixing/Loading/Applying Liquid Formulation with a Sprinkler Can **(7)**	-----	No Engineering Controls[e]	-----	No Engineering Controls[e]	-----	-----	-----
Mixing/Loading/Applying Liquid Concentrate **(8)**	-----	No data[g]	-------	No data	-------	-------	-------
		No data	-------	No data	-------	-------	-------
Dipping in Liquid Formulation **(9)**	-----	No data	-------	No data	-------	-------	-------
IV. Flaggers							
Flagging Granular Application with Fixed-wing Aircraft **(10)**	Ag - 6 (low)	0.0022	0.066	0.14	0.0042	0.070	<1
	Ag - 12 (high)		0.13		0.0084	0.14	<1

Footnotes

a Eng Controls Daily Exposure (mg/day) = unit exposure (mg/lb ai)*application rate (lb ai/acre)* acres treated/day
For acres treated per day see Table 1

b Eng Control Daily Dose (mg/kg/day) = (Eng Controls Daily Exposure (mg/day) / Body weight (70 kg).

c Eng. Controls Total Daily Dose = [(Eng Controls Daily Dermal Dose (mg/kg/day) + Eng. Controls Daily Inhalation Dose (mg/kg/day)] / 70 kg).

d Eng. Controls Total MOE = NOEL (0.025 mg/kg/day)/(Eng. Controls Daily Total Dose).
Eng. Control Total MOEs presented for low, medium and high application rates for each scenario.

e There are no known engineering controls for this scenario.

f Engineering Controls:

1a/1b: Assume use of a Lock n' Load product - For dermal a 90% protection factor (PF) is applied to all baseline dermal exposure; for inhalation a 90% PF is applied to baseline inhalation exposure

2a/2b: Mechanical Transfer or Gel-Tec water soluble packaging; single layer clothing

3a: Enclosed cockpit; single layer clothing, and chemical resistant gloves

3b: Enclosed tractor cab; single layer clothing

4: Enclosed tractor cab: single layer clothing

10: Enclosed tractor cab: single layer clothing

g No data No data in PHED for this scenario

Table 5: Combined Dermal and Inhalation Cancer Risk From Ethoprop Baseline and With Additional PPE

Exposure Scenario (Scen #)	Range of Maximum Application Rates and Crop Type (lb ai/acre)	Baseline Daily Total Dose (mg/kg/day)[a]	Number of Treatments per Crop/ Season[b]	Baseline (Total) LADD[c] (mg/kg/day)	Baseline (Total) Risk[d]	Risk Mitigation		
						PPE (Total) Dose[e] (mg/kg/day)	PPE (Total) LADD[c] (mg/kg/day)	PPE Total Risk[d]
I. Mixer/Loader Cancer Risk								
Loading Granular for Application by Fixed Wing Aircraft **(1a)**	Ag - 6 (low)	0.29	1	4.0 E-04	1.1 E-05	0.14	1.9 E-04	5.3 E-06
	Ag - 6 (low)	0.29	10 (C)	4.0 E-03	1.1 E-04	0.14	1.9 E-03	5.3 E-05
	Ag - 12 (high)	0.56	1	7.7 E-04	2.2 E-05	0.27	3.7 E-04	1.0 E-05
	Ag - 12 (high)	0.56	10 (C)	7.7 E-03	2.2 E-04	0.27	3.7 E-03	1.0 E-04
Loading Granular for Application with a Tractor-Drawn Mechanical Spreader **(1b)**	Ag - 2 (low)	0.021	1	2.9 E-05	8.1 E-07	0.0051	7.0 E-06	2.0 E-07
	Ag - 2 (low)	0.021	10 (C)	2.9 E-04	8.1 E-06	0.0051	7.0 E-05	2.0 E-06
	Ag - 6 (med)	0.063	1	8.6 E-05	2.4 E-06	0.030	4.1 E-05	1.2 E-06
	Ag - 6 (med)	0.063	10 (C)	8.6 E-04	2.4 E-05	0.030	4.1 E-04	1.2 E-05
	Ag - 6 (med)	0.063	2	1.7 E-04	4.8 E-06	0.030	8.2 E-05	2.3 E-06
	Ag - 6 (med)	0.063	20 (C)	1.7 E-03	4.8 E-05	0.030	8.2 E-04	2.3 E-05
	Ag - 12 (high)	0.13	1	1.8 E-04	5.1 E-06	0.061	8.4 E-05	2.4 E-06
	Ag - 12 (high)	0.13	10 (C)	1.8 E-03	5.1 E-05	0.061	8.4 E-04	2.4 E-05
	Turf - 20	0.11	1	1.5 E-04	4.2 E-06	0.051	7.0 E-05	2.0 E-06
	Turf - 20	0.11	10 (C)	1.5 E-03	4.2 E-05	0.051	7.0 E-04	2.0 E-05
	Turf - 20	0.11	2	3.0 E-04	8.4 E-06	0.051	1.4 E-04	3.9 E-06
	Turf - 20	0.11	20 (C)	3.0 E-03	8.4 E-05	0.051	1.4 E-03	3.9 E-05
Mixing/Loading Liquid Formulation for Chemigation **(2a)**	Ag - 2 (low)	29	1	4.0 E-02	1.1 E-03	0.25	3.4 E-04	9.6 E-06
	Ag - 2 (low)	29	10 (C)	4.0 E-01	1.1 E-02	0.25	3.4 E-03	9.6 E-05
	Ag - 6 (med)	87	1	1.2 E-01	3.4 E-03	0.75	1.0 E-03	2.8 E-05
	Ag - 6 (med)	87	10 (C)	1.2 E-00	3.4 E-02	0.75	1.0 E-02	2.8 E-04

Table 5: Combined Dermal and Inhalation Cancer Risk From Ethoprop Baseline and With Additional PPE

Exposure Scenario (Scen #)	Range of Maximum Application Rates and Crop Type (lb ai/acre)	Baseline Daily Total Dose (mg/kg/day)[a]	Number of Treatments per Crop/ Season[b]	Baseline (Total) LADD[c] (mg/kg/day)	Baseline (Total) Risk[d]	Risk Mitigation		
						PPE (Total) Dose[e] (mg/kg/day)	PPE (Total) LADD[c] (mg/kg/day)	PPE Total Risk[d]
	Ag - 6 (med)	87	2	2.4 E-01	6.7 E-03	0.75	2.1 E-03	5.9 E-05
	Ag - 6 (med)	87	20 (C)	2.4 E-00	6.7 E-02	0.75	2.1 E-02	5.9 E-04
	Ag - 6 (med)	87	8	9.0 E-01	2.7 E-02	0.75	8.2 E-03	2.3 E-04
	Ag - 6 (med)	87	80 (C)	9.0 E-00	2.7 E-01	0.75	8.2 E-02	2.3 E-03
	Ag - 12 (high)	170	1	2.3 E-01	6.5 E-03	1.5	2.1 E-03	5.9 E-05
	Ag - 12 (high)	170	10 (C)	2.3 E-00	6.5 E-02	1.5	2.1 E-02	5.9 E-04
	Ag - 2 (low)	6.6	1	9.0 E-03	2.5 E-04	0.057	7.8 E-05	2.2 E-06
	Ag - 2 (low)	6.6	10 (C)	9.0 E-02	2.5 E-03	0.057	7.8 E-04	2.2 E-05
	Ag - 6 (med)	20	1	2.7 E-02	7.6 E-04	0.17	2.3 E-04	6.5 E-06
	Ag - 6 (med)	20	10 (C)	2.7 E-01	7.6 E-03	0.17	2.3 E-03	6.5 E-05
	Ag - 6 (med)	20	2	5.5 E-02	1.6 E-03	0.17	4.7 E-04	1.3 E-05
	Ag - 6 (med)	20	20 (C)	5.5 E-01	1.6 E-02	0.17	4.7 E-03	1.3 E-04
	Ag - 6 (med)	20	8	2.2 E-01	6.2 E-03	0.17	1.9 E-03	5.3 E-05
	Ag - 6 (med)	20	80 (C)	2.2 E-00	6.2 E-02	0.17	1.9 E-02	5.3 E-04
	Ag - 12 (high)	40	1	5.5 E-02	1.5 E-03	0.34	4.7 E-04	1.3 E-05
	Ag - 12 (high)	40	10 (C)	5.5 E-01	1.5 E-02	0.34	4.7 E-03	1.3 E-04
Mixing/Loading Liquid Formulation for Groundboom Application **(2b)**	Ag - 2 (low)	6.6	1	9.0 E-03	2.5 E-04	0.057	7.8 E-05	2.2 E-06
	Ag - 2 (low)	6.6	10 (C)	9.0 E-02	2.5 E-03	0.057	7.8 E-04	2.2 E-05
	Ag - 6 (med)	20	1	2.7 E-02	7.6 E-04	0.17	2.3 E-04	6.5 E-06
	Ag - 6 (med)	20	10 (C)	2.7 E-01	7.6 E-03	0.17	2.3 E-03	6.5 E-05
	Ag - 12 (high)	40	1	5.5 E-02	1.5 E-03	0.34	4.7 E-04	1.3 E-05
	Ag - 12 (high)	40	10	5.5 E-01	1.5 E-02	0.34	4.7 E-03	1.3 E-04

Table 5: Combined Dermal and Inhalation Cancer Risk From Ethoprop Baseline and With Additional PPE

Exposure Scenario (Scen #)	Range of Maximum Application Rates and Crop Type (lb ai/acre)	Baseline Daily Total Dose (mg/kg/day)[a]	Number of Treatments per Crop/ Season[b]	Baseline (Total) LADD[c] (mg/kg/day)	Baseline (Total) Risk[d]	Risk Mitigation		
						PPE (Total) Dose[e] (mg/kg/day)	PPE (Total) LADD[c] (mg/kg/day)	PPE Total Risk[d]
II. Applicator Risk								
Applying Granular with Fixed-wing Aircraft **(3a)**	-----	See Eng. Controls.	-----	-----	-----	-----	------	-----
		See Eng. Controls	-----	-----	-----	-----	-----	-----
Applying Granular with a Tractor-Drawn Mechanical Spreader **(3b)**	Ag - 2 (low)	0.026	1	3.6 E-05	1.0 E-07	0.0090	1.2 E-05	3.5 E-07
	Ag - 2 (low)	0.026	10 (C)	3.6 E-04	1.0 E-06	0.0090	1.2 E-04	3.5 E-06
	Ag - 6 (med)	0.077	1	1.1 E-04	3.1 E-06	0.027	3.7 E-05	1.0 E-06
	Ag - 6 (med)	0.077	10 (C)	1.1 E-03	3.1 E-05	0.027	3.7 E-04	1.0 E-05
	Ag - 6 (med)	0.077	2	2.1 E-04	5.9 E-06	0.027	7.4 E-05	2.1 E-06
	Ag - 6 (med)	0.077	20 (C)	2.1 E-03	5.9 E-05	0.027	7.4 E-04	2.1 E-05
	Ag - 12 (high)	0.16	1	2.2 E-04	6.2 E-06	0.054	7.4 E-05	2.1 E-06
	Ag - 12 (high)	0.16	1 (C)	2.2 E-03	6.2 E-05	0.054	7.4 E-04	2.1 E-05
	Turf - 20	0.13	1	1.8 E-04	5.1 E-06	0.045	6.0 E-05	1.7 E-06
	Turf - 20	0.13	10 (C)	1.8 E-03	5.1 E-05	0.045	6.0 E-04	1.7 E-05
	Turf - 20	0.13	2	3.6 E-04	1.0 E-05	0.045	1.2 E-04	3.4 E-06
	Turf - 20	0.13	20 (C)	3.6 E-03	1.0 E-04	0.045	1.2 E-03	3.4 E-05
Applying Sprays with a Groundboom Sprayer **(4)**	Ag - 2 (low)	0.036	1	4.9 E-05	1.4 E-06	0.023	3.2 E-05	9.0 E-07
	Ag - 2 (low)	0.036	10 (C)	4.9 E-04	1.4 E-05	0.023	3.2 E-04	9.0 E-06
	Ag - 6 (med)	0.11	1	1.5 E-04	4.2 E-06	0.069	9.5 E-05	2.7 E-06
	Ag - 6 (med)	0.11	10	1.5 E-03	4.2 E-05	0.069	9.5 E-04	2.7 E-05
	Ag - 12 (high)	0.21	1	2.9 E-04	8.1 E-06	0.14	1.9 E-04	5.3 E-06
	Ag - 12 (high)	0.21	10	2.9 E-03	8.1 E-05	0.14	1.9 E-03	5.3 E-05
III. Mixer /Loader /Applicator Cancer Risk								

Table 5: Combined Dermal and Inhalation Cancer Risk From Ethoprop Baseline and With Additional PPE

Exposure Scenario (Scen #)	Range of Maximum Application Rates and Crop Type (lb ai/acre)	Baseline Daily Total Dose (mg/kg/day)[a]	Number of Treatments per Crop/ Season[b]	Baseline (Total) LADD[c] (mg/kg/day)	Baseline (Total) Risk[d]	Risk Mitigation		
						PPE (Total) Dose[e] (mg/kg/day)	PPE (Total) LADD[c] (mg/kg/day)	PPE Total Risk[d]
Loading/Applying Granular with a Push-type Granular Spreader **(5a)**	Turf - 20	6.6	2	1.8 E-02	5.1 E-04	1.7	4.7 E-03	1.3 E-04
	Turf - 20	6.6	20 (C)	1.8 E-01	5.1 E-03	1.7	4.7 E-02	1.3 E-03
Loading/Applying Granular by Hand **(5b)**	Ag - 26 banana and plantain	37	2	1.0 E-01	2.8 E-03	14	3.8 E-02	1.1 E-02
	Ag - 26 banana and plantain	37	20 (C)	1.0 E-00	2.8 E-02	14	3.8 E-01	1.1 E-01
Mixing/Loading/Applying Liquid Formulation with a Low-Pressure Handwand Sprayer **(6a)**	Ag 5 (non-bearing citrus trunks)	57	2	1.6 E-01	4.5 E-03	1.8	4.9 E-03	1.4 E-04
	Ag 5 (non-bearing citrus trunks)	57	20 (C)	1.6 E-00	4.5 E-02	1.8	4.9 E-02	1.4 E-03
Mixing/Loading/Applying Liquid Formulation with a Backpack Sprayer **(6b)**	Ag 5 (non-bearing citrus trunks)	1.4	2	3.8 E-03	1.1 E-04	0.74	2.0 E-03	5.6 E-05
	Ag 5 (non-bearing citrus trunks)	1.4	20 (C)	3.8 E-02	1.1 E-03	0.74	2.0 E-02	5.6 E-04
Mixing/Loading/Applying Liquid Formulation with a Sprinkler Can **(7)**	Ag - 3 (low)	1.3	10	1.8 E-03	5.1 E-05	0.18	2.5 E-04	7.0 E-06
	Ag - 3 (low)	1.3	10 (C)	1.8 E-02	5.1 E-04	0.18	2.5 E-03	7.0 E-05
	Ag - 6 (high)	2.7	1	3.7 E-03	1.0 E-04	0.37	5.1 E-04	1.4 E-05
	Ag - 6 (high)	2.7	10 (C)	3.7 E-02	1.0 E-03	0.37	5.1 E-03	1.4 E-04
Mixing/Loading/Applying Liquid Concentrate **(8)**	-----	No data[f]	No data	No data	No data	No data	No data	No data
Dipping in Liquid Formulation **(9)**	-----	No data	No data	No data	No data	No data	No data	No data
IV. Flagger Cancer Risk								
Flagging Granular Application with Fixed-Wing Aircraft **(10)**	Ag - 6 (low)	0.080	1	1.1 E-04	3.1 E-06	0.039	5.3 E-05	1.5 E-06
	Ag - 6 (low)	0.080	10 (C)	1.1 E-03	3.1 E-05	0.039	5.3 E-04	1.5 E-05
	Ag - 12 (high)	0.17	1	2.3 E-04	6.4 E-06	0.079	1.1 E-04	3.1 E-06
	Ag - 12 (high)	0.17	10 (C)	2.3 E-03	6.4 E-05	0.079	1.1 E-03	3.1 E-05

Footnotes

(C) commercial applicator

a Baseline Daily Total Dose (mg/kg/day) - See Table 3
b Number of Treatments per year are based on 264-457, 264-546, 264-458, and SLN FL-870001 with the high end accounting for individuals working at more than one site.
c LADD (mg/kg/day) = Daily Dose (mg/kg/day) * (number of days per year worked / 365 days per year) * (35 years worked / 70 years lifetime).
Where number of days per year worked = number of treatments per crop/season
d Risk = LADD (mg/kg/day) * (Q_1^*). Where $Q_1^* = 2.81$ E-2 $(mg/kg/day)^{-1}$
e PPE Total Dose (mg/kg/day) - See Table 3
f N/A (Not Available) = There are no known PPE controls for this scenario.
No data = No data in PHED for this scenario

Table 6: Combined Dermal and Inhalation Cancer Risk From Ethoprop Engineering Controls

Exposure Scenario (Scen #)	Range of Maximum Application rates and Crop Types (lb ai/acre)	Number of Treatments per Crop/ Season[a]	Risk Mitigation		
			Eng. Controls (Total) Dose[b] (mg/kg/day)	Eng. Controls (Total) LADD[c] (mg/kg/day)	Eng. Controls Total Risk[d]
I. Mixer/Loader Cancer Risk					
Loading Granular for Application by Fixed Wing Aircraft **(1a)**	Ag - 6 (low)	1	0.028	3.8 E-05	1.1 E-06
	Ag - 6 (low)	10 (C)	0.028	3.8 E-04	1.1 E-05
	Ag - 12 (high)	1	0.056	7.7 E-05	2.1 E-06
	Ag - 12 (high)	10 (C)	0.056	7.7 E-04	2.1 E-05
Loading Granular for Application with a Tractor-Drawn Mechanical Spreader **(1b)**	Ag - 2 (low)	1	0.0056	7.6 E-06	2.2 E-07
	Ag - 2 (low)	10 (C)	0.0056	7.6 E-05	2.2 E-06
	Ag - 6 (med)	1	0.0064	8.8 E-06	2.5 E-07
	Ag - 6 (med)	10 (C)	0.0064	8.8 E-05	2.5 E-06
	Ag - 6 (med)	2	0.0064	1.8 E-05	4.9 E-07
	Ag - 6 (med)	20 (C)	0.0064	1.8 E-04	4.9 E-06
	Ag - 12 (high)	1	0.012	1.6 E-05	4.6 E-06
	Ag - 12 (high)	10 (C)	0.012	1.6 E-04	4.6 E-07
	Turf - 20	1	0.011	1.5 E-05	4.2 E-06
	Turf - 20	10 (C)	0.011	1.5 E-04	4.2 E-07
	Turf - 20	2	0.011	3.0 E-05	8.5 E-07
	Turf - 20	20 (C)	0.011	3.0 E-04	8.5 E-06
Mixing/Loading Liquid Formulation for Chemigation **(2a)**	Ag - 2 (low)	1	0.091	1.2 E-04	3.4 E-06
	Ag - 2 (low)	10 (C)	0.091	1.2 E-03	3.4 E-05
	Ag - 6 (med)	1	0.27	3.7 E-04	1.0 E-05
	Ag - 6 (med)	10 (C)	0.27	3.7 E-03	1.0 E-04
	Ag - 6 (med)	**2**	0.27	7.4 E-04	2.1 E-05
	Ag - 6 (med)	20 (C)	0.27	7.4 E-03	2.1 E-04

Table 6: Combined Dermal and Inhalation Cancer Risk From Ethoprop Engineering Controls

Exposure Scenario (Scen #)	Range of Maximum Application rates and Crop Types (lb ai/acre)	Number of Treatments per Crop/ Season[a]	Risk Mitigation		
			Eng. Controls (Total) Dose[b] (mg/kg/day)	Eng. Controls (Total) LADD[c] (mg/kg/day)	Eng. Controls Total Risk[d]
	Ag - 6 (med)	8	0.27	3.0 E-03	8.4 E-05
	Ag - 6 (med)	80 (C)	0.27	3.0 E-02	8.4 E-04
	Ag - 12 (high)	1	0.54	7.4 E-04	2.1 E-05
	Ag - 12 (high)	10 (C)	0.54	7.4 E-03	2.1 E-04
	Ag - 2 (low)	1	0.021	2.9 E-05	8.2 E-07
	Ag - 2 (low)	10 (C)	0.021	2.9 E-04	8.2 E-06
	Ag - 6 (med)	1	0.063	8.6 E-05	2.4 E-06
	Ag - 6 (med)	10 (C)	0.063	8.6 E-04	2.4 E-05
	Ag - 6 (med)	2	0.063	1.7 E-04	4.9 E-06
	Ag - 6 (med)	20 (C)	0.063	1.7 E-03	4.9 E-05
	Ag - 6 (med)	8	0.063	6.9 E-04	1.9 E-05
	Ag - 6 (med)	80 (C)	0.063	6.9 E-03	1.9 E-04
	Ag - 12 (high)	1	0.12	1.6 E-04	4.5 E-06
	Ag - 12 (high)	10 (C)	0.12	1.6 E-03	4.5 E-05
Mixing/Loading Liquid Formulation for Groundboom Application **(2b)**	Ag - 2 (low)	1	0.021	2.9 E-05	8.2 E-07
	Ag - 2 (low)	10 (C)	0.021	2.9 E-04	8.2 E-06
	Ag - 6 (med)	1	0.063	8.6 E-05	2.4 E-06
	Ag - 6 (med)	10 (C)	0.063	8.6 E-04	2.4 E-05
	Ag - 12 (high)	1	0.12	1.6 E-04	4.5 E-06
	Ag - 12 (high)	10 (C)	0.12	1.6 E-03	4.5 E-05
II. Applicator Risk					
Applying Granular with Fixed-wing Aircraft **(3a)**	Ag - 6 (low)	1	0.017	2.3 E-05	6.5 E-07
	Ag - 6 (low)	10 (C)	0.017	2.3 E-04	6.5 E-06
	Ag - 12 (high)	1	0.034	4.7 E-05	1.3 E-06
	Ag - 12 (high)	10 (C)	0.034	4.7 E-04	1.3 E-05

Table 6: Combined Dermal and Inhalation Cancer Risk From Ethoprop Engineering Controls

Exposure Scenario (Scen #)	Range of Maximum Application rates and Crop Types (lb ai/acre)	Number of Treatments per Crop/ Season[a]	Risk Mitigation		
			Eng. Controls (Total) Dose[b] (mg/kg/day)	Eng. Controls (Total) LADD[c] (mg/kg/day)	Eng. Controls Total Risk[d]
Applying Granular with a Tractor-Drawn Mechanical Spreader **(3b)**	Ag - 2 (low)	1	0.0055	7.5 E-06	2.1 E-07
	Ag - 2 (low)	10 (C)	0.0055	7.5 E-05	2.1 E-06
	Ag - 6 (med)	1	0.017	2.3 E-05	6.5 E-07
	Ag - 6 (med)	10 (C)	0.017	2.3 E-04	6.5 E-06
	Ag - 6 (med)	2	0.017	4.7 E-05	1.3 E-06
	Ag - 6 (med)	20 (C)	0.017	4.7 E-04	1.3 E-05
	Ag - 12 (high)	1	0.033	4.5 E-05	1.3 E-06
	Ag - 12 (high)	10 (C)	0.033	4.5 E-04	1.3 E-05
	Turf - 20	1	0.028	3.8 E-05	1.1 E-06
	Turf - 20	10 (C)	0.028	3.8 E-04	1.1 E-05
	Turf - 20	2	0.028	7.7 E-05	2.2 E-06
	Turf - 20	20 (C)	0.028	7.7 E-04	2.2 E-05
Applying Sprays with a Groundboom Sprayer **(4)**	Ag - 2 (low)	1	0.015	2.1 E-05	5.9 E-07
	Ag - 2 (low)	10 (C)	0.015	2.1 E-04	5.9 E-06
	Ag -6 (med)	1	0.046	6.3 E-05	1.8 E-06
	Ag - 6 (med)	10 (C)	0.046	6.3 E-04	1.8 E-05
	Ag - 12 (high)	1	0.093	1.3 E-04	3.7 E-06
	Ag - 12 (high)	10 (C)	0.093	1.3 E-03	3.7 E-05
III. Mixer /Loader /Applicator Cancer Risk					
Loading/Applying Granular with a Push-type Granular Spreader **(5a)**	Turf - 20	2	NA	NA	NA
	Turf - 20	20 (C)	NA	NA	NA
Loading/Applying Granular by Hand **(5b)**	0.0132 banana and plantain	2	NA	NA	NA
	Ag - 26 banana and plantain	20 (C)	NA	NA	NA
Mixing/Loading/Applying Liquid Formulation with a Low-Pressure Handwand Sprayer **(6a)**	Ag - 5 (non-bearing citrus)	2	No Engineering Controls[e]	-----	-----

Table 6: Combined Dermal and Inhalation Cancer Risk From Ethoprop Engineering Controls

Exposure Scenario (Scen #)	Range of Maximum Application rates and Crop Types (lb ai/acre)	Number of Treatments per Crop/ Season[a]	Risk Mitigation		
			Eng. Controls (Total) Dose[b] (mg/kg/day)	Eng. Controls (Total) LADD[c] (mg/kg/day)	Eng. Controls Total Risk[d]
		20 (C)	No Engineering Controls	-----	-----
Mixing/Loading/Applying Liquid Formulation with a Backpack Sprayer **(6b)**	Ag - 5 (non-bearing citrus)	2	No Engineering Controls	-----	-----
		20 (C)	No Engineering Controls	-----	-----
Mixing/Loading/Applying Liquid Formulation with a Sprinkler Can **(7)**	Ag - 3 (low)	1	No Engineering Controls	-----	-----
	Ag - 3 (low)	10 (C)	No Engineering Controls	-----	-----
	Ag - 6 (high)	1	No Engineering Controls	-----	-----
	Ag - 6 (high)	10 (C)	No Engineering Controls	-----	-----
Mixing/Loading/Applying Liquid Concentrate **(8)**	Ag - 26 banana, plantain	-----	No data[f]	-----	-----
Dipping in Liquid Formulation **(9)**	0.0075 lb/gal citrus seedlings	-----	No data	-----	-----
IV. Flagger Cancer Risk					
Flagging Granular Application with Fixed-Wing Aircraft **(10)**	Ag - 6 (low)	1	0.070	9.6 E-05	2.7 E-06
	Ag - 6 (low)	10 (C)	0.070	9.6 E-04	2.7 E-05
	Ag - 12 (high)	1	0.14	1.9 E-04	5.3 E-06
	Ag - 12 (high)	10 (C)	0.14	1.9 E-03	5.3 E-05

Footnotes

(C) Commercial Applicators

a Number of Treatments per year are based on Rhone Poulenc's MOCAP 15% Granular (Reg. No. 264-457), Chipco MOCAP 10G GC (264-546), MOCAP EC (264-458) and Ethoprop EC (SLN FL-870001) labels, with the high end accounting for individuals working at more than one site.

b Engineering Controls Total Dose (mg/kg/day) - See Table 4

c Engineering Controls Total LADD (mg/kg/day) = Engineering Controls Total Daily Dose (mg/kg/day) * (number of days per year worked / 365 days per year) * (35 years worked / 70 years lifetime). Where number of days per year worked = number of treatments per crop/season

d Engineering Controls Total Risk =Engineering Controls Total LADD (mg/kg/day) * (Q_1^*). Where $Q_1^* = 2.81$ E-2 $(mg/kg/day)^{-1}$

e There are no known engineering controls for this scenario.

f No data = No data in PHED for this scenario

Table 7: Exposure Scenario Descriptions for the Use of Ethoprop

Exposure Scenario (Number)	Data Source	Standard Assumptions[a] (8-hr work day)	Comments[b]
Mixer/Loader Descriptors			
Loading Granular Formulation (1a/1b)	PHED V1.1	1) 350 acres for aerial applications; 2) 80 acres for tractor drawn spreaders in agricultural settings; 3) 40 acres for golf course turf	**Baseline:** Hand = all grades; dermal = acceptable grades; and inhalation = acceptable grades. Hands = 10 replicates; dermal = 29 to 36 replicates; and inhalation = 58 replicates. Low confidence in dermal/ hand data. High confidence in inhalation data. No protection factor was needed to define the unit exposure value. **PPE**: The available dermal data were coupled with a 50% protection factor to account for an additional layer of clothing. Hand = acceptable grades and dermal = ABC grades. Hands = 45 replicates; and dermal= 29 to 36 replicates. High confidence in dermal and hand data. **Engineering Controls:** Lock 'N Load™ products. Assume 90% protection factor (PF) for both baseline dermal and inhalation exposure
Mixing/Loading Liquid Formulation (2a/2b)	PHED V1.1	1) 350 acres for chemigation, and 2) 80 acres for groundboom in agricultural settings	**Baseline:** Hand, dermal, and inhalation are acceptable grades. Hand = 53 replicates; Dermal = 25 to 122 replicates; and Inhalation = 85 replicates. High confidence in hand/dermal and inhalation data. No protection factor was needed to define the unit exposure value. **PPE:** The same dermal data are used as for the baseline coupled with a 50% protection factor to account for an additional layer of clothing. Hand = acceptable grades. Hands = 59 replicates. High confidence in hand/dermal data. **Engineering Controls:** Hand and dermal unit exposures are acceptable grades. Hand = 31 replicates; and Dermal = 16 to 22 replicates. High confidence in dermal and hand data. Gloves were worn during the use of the engineering controls. No protection factor was needed to define the unit exposure value.
Applicator Descriptors			
Applying Granules with Fixed-wing Aircraft (3a)	PHED V1.1	350 acres in agricultural settings	**Minimal Clothing:** Hand = all grades; dermal = grade C; and inhalation = all grades. Hands = 4 replicates; dermal = 9 to 13 replicates; and inhalation = 13 replicates. Low confidence in dermal/ hand, and inhalation data. **Baseline:** This is a major data gap in PHED. **Engineering Controls:** Enclosed cab. Assume 90% protection factor for both minimal clothing dermal and inhalation exposure.
Applying Granular with a Tractor Drawn Spreader (3b)	PHED V1.1	1) 80 acres - agricultural and 2) 40 acres on golf course turf	**Baseline:** Hands, dermal, and inhalation = acceptable grades. Hands = 5 replicates; dermal = 1 to 5 replicates; and inhalation = 5 replicates. Low confidence in hand, dermal, and inhalation data. No protection factor was required to define the unit exposure value. **PPE:** The same dermal and hand data are used as for the baseline coupled with a 50% protection factor to account for an additional layer of clothing and a 90% protection factor to account for the use of chemical resistant gloves. **Engineering Controls:** Hand and dermal = acceptable grades. Hands = 24 replicates and dermal = 2-30 replicates. Low confidence in hand/dermal data. Inhalation = 37 replicates, acceptable grades. High confidence in inhalation data.

Table 7: Exposure Scenario Descriptions for the Use of Ethoprop

Exposure Scenario (Number)	Data Source	Standard Assumptions[a] (8-hr work day)	Comments[b]
Applying Sprays with a Groundboom Sprayer (4)	PHED V1.1	1) 80 acres in agricultural settings and 2) 40 acres on field-grown ornamentals	**Baseline:** Hand, dermal, and inhalation acceptable grades. Hands = 29 replicates, dermal = 32 to 42 replicates, and inhalation = 22 replicates. High confidence in hand, dermal, and inhalation data. No protection factor was required to define the unit exposure value. **PPE:** The same dermal non-hand data are used as for the baseline with a 50% protection factor to simulate an additional layer of clothing (coveralls). Hand = ABC grades. Hands = 21 replicates. Medium confidence in dermal/ hand data. A 90% PF was applied to the baseline inhalation exposure to simulate a respirator. **Engineering Controls:** Hand and dermal = ABC grades. Hands= 16 replicates and dermal = 20 to 31 replicates. Medium confidence in hand and dermal data. Inhalation = 16 replicates, AB grade. High confidence in inhalation data.
Mixer/Loader/Applicator Descriptors			
Mixing/Loading/Applying with a Push-Type Granular Spreader (5a)	PHED V1.1	5 acres - golf-course turf	**Baseline:** Hand and dermal =A,B,C grades; and inhalation = acceptable grades. Hand = 15 replicates; dermal = 0 to 15 replicates; and inhalation = 15 replicates. Low to medium confidence in the dermal and hand data. High confidence in the inhalation data. No protection factor was required to define the unit exposure scenario. **PPE:** Derived by calculation from baseline data. The same dermal data and hand data are used as for the baseline with a 50% protection factor applied to non-hand dermal data to simulate an additional layer of clothing (coveralls), and a 90% protection factor to hand data to simulate the use of chemical resistant gloves. A 90% PF was applied to the baseline inhalation exposure to simulate a respirator. **Engineering Controls:** There are no known engineering controls for this scenario.
Loading/Applying Granular by Hand (5b)	PHED V1.1	1 acre - agricultural use (banana/plantain)	**Baseline:** Dermal = ABC grades; and inhalation = ABC grades. Hands = no replicates; dermal = 16 replicates; and inhalation = 16 replicates. Confidence in hand and dermal data = N/A; in inhalation data = Medium. Baseline data includes chemical-resistant gloves. Hand data without gloves are back-calculated by multiplying glove data by 10. No protection factor was required to define the unit exposure value. **PPE:** The same non-hand dermal data are used as for baseline with a 50% protection factor to simulate an additional layer of clothing (coveralls). Hand with gloves = 15 replicates, grades ABC, medium confidence. A 90% PF was applied to the baseline inhalation exposure to simulate a respirator. **Engineering Controls:** There are no known engineering controls for this scenario.
Mixing/Loading/Applying with a Low Pressure Handwand (6a)	PHED V1.1	1 acre - agricultural use	**Baseline:** Hand and dermal = All grades and inhalation = All grades. Hand = 70 replicates, dermal = 25-96 replicates, and inhalation = 96 replicates. Low confidence in hand, dermal, and inhalation data. No protection factor was required to define the unit exposure value. **PPE:** The same non-hand dermal data are used as for the baseline with a 50% protection factor to simulate an additional layer of clothing (coveralls). Hand data are acceptable grade. Hand = 15 replicates. Low confidence in dermal/hand data. A 90% PF was applied to the baseline inhalation exposure to simulate a respirator. **Engineering Controls:** There are no known engineering controls for this scenario.

Table 7: Exposure Scenario Descriptions for the Use of Ethoprop

Exposure Scenario (Number)	Data Source	Standard Assumptions[a] (8-hr work day)	Comments[b]
Mixing/Loading/Applying with a Backpack Sprayer (6b)	PHED V1.1	5 acres - agricultural use	**Baseline:** Hands and dermal = ABC grades; and inhalation = acceptable grades. Hands = 11 replicates; dermal = 9-11 replicates; and inhalation = 11 replicates. Low confidence in hand, dermal, and inhalation data. Baseline data includes chemical-resistant gloves. No protection factor was required to define the unit exposure value. **PPE:** Derived by calculation from baseline data. The same dermal data and hand data are used as for the baseline with a 50% protection factor applied to non-hand dermal data to simulate an additional layer of clothing (coveralls), and a 90% protection factor to hand data to simulate the use of chemical resistant gloves. A 90% PF was applied to the baseline inhalation exposure to simulate a respirator. **Engineering Controls:** There are no known engineering controls for this scenario.
Mixing/loading/applying liquids with a sprinkler can (7)	PHED V1.1	1 acre - ornamentals	**Baseline**: Hand and dermal = All grades; and inhalation = Grade C. Hand = 8 replicates; dermal = 8 replicates; and inhalation = 8 replicates. Low confidence in hand and dermal data. Low confidence in inhalation data. No protection factor was required to define the unit exposure. **PPE:** Derived by back calculation from baseline data. The same dermal data and hand data are used as for the baseline with a 50% protection factor applied to non-hand dermal data to simulate an additional layer of clothing (coveralls), and a 90% protection factor to hand data to simulate the use of chemical resistant gloves. A 90% PF was applied to the baseline inhalation exposure to simulate a respirator. **Engineering Controls:** There are no known engineering controls for this scenario.
Mixing/Loading/Applying Liquid Concentrate (8)	---	---	No data in PHED for this scenario
Dipping in Liquid Formulation (9)	---	---	No data in PHED for this scenario
Flagging Granular Application with Fixed - Wing Aircraft (10)	PHED V1.1	350 acres - agricultural	**Baseline:** Dermal, hand, and inhalation = all grades. Dermal = 16 - 20 replicates; hand = 4 replicates; inhalation = 4 replicates. Low confidence in all data. **PPE:** The same non-hand dermal data are used as for the baseline with a 50% protection factor to simulate an additional layer of clothing (coveralls). Hand data = all grades. Hand = 4 replicates. Low confidence in dermal/hand data. A 90% PF was applied to the baseline inhalation exposure to simulate a respirator. **Engineering Controls:** Based on data for groundboom, enclosed cab.

[a] All *Standard Assumptions* are based on an 8-hour work day as estimated by HED.

[b] All handler exposure assessments in this document are based on the "Best Available" data as defined by the HED SOP for meeting Subdivision U Guidelines (i.e., completing exposure assessments). Best available grades are assigned to data as follows: matrices with A and B grade data (i.e., Acceptable Grade Data) and a minimum of 15 replicates; if not available, then grades A, B and C data and a minimum of 15 replicates; if not available, then all data regardless of the quality (i.e., All Grade Data) and number of replicates. High quality data with a protection factor take precedence over low quality data with no protection factor. Generic data confidence categories are assigned as follows:

High = grades A and B and 15 or more replicates per body part
Medium = grades A, B, and C and 15 or more replicates per body part
Low = grades A, B, C, D and E or any combination of grades with less than 15 replicates.

v. Summary of Dermal and Total Risk from Handler Exposures

Agricultural uses of ethoprop must have (1) MOEs greater than or equal to 100 when considering short-term and intermediate-term scenarios, for both dermal and inhalation exposures AND (2) the cancer risk (considering both dermal and inhalation exposures) should be in the range of 10^{-4} to 10^{-6} or lower.

To achieve the range of 10^{-4} to 10^{-6} or lower, mitigation is required. Carcinogenic risks require use of PPE (coveralls, gloves, respirator) or engineering controls. However, despite use of all available PPE, carcinogenic risk is greater than 10^{-4} for commercial applicators for scenarios 5a (loading/applying granules with a push-type granular spreader) and 6a (mixing/loading/applying sprays with a low pressure handwand). Note that no engineering controls are available for these two scenarios.

With two exceptions, the MOEs estimated for short- and intermediate-term are less than 100 (and in many cases are less than 1). An additional consideration is that both of these exceptions are MOEs that were estimated using dermal exposure only.

Thus, at this time for occupational exposures, HED cannot recommend for any agricultural uses of ethoprop through reregistration. Note that estimation of post-application exposures and resultant risks will be postponed until risks for pesticide handlers are determined to be not of concern.

Attachment 1 Summary - Ethoprop Pesticide Product Labels					
EPA Registration No.	**Product Name**	**Percent A.I.**	**Crop & (Min/Max Application Rates)** **(lb ai/Acre)**	**Comments**	**Manufacturer**
I. <u>Products Currently Marketed</u> (Registrant has stated that these labels are "in active use.")					
264-456	Ethoprop (Technical grade)	95%	Banana Beans (dry, lima, snap) Cabbage Corn (field & sweet) Cucumber Peanut Pineapples Plantain Potato - White, Irish Potato - Sweet Sugarcane Citrus Seedlings Commercial Turf Ornamentals Tobacco		Rhone Poulenc AG

Attachment 1 Summary - Ethoprop Pesticide Product Labels					
EPA Registration No.	**Product Name**	**Percent A.I.**	**Crop & (Min/Max Application Rates)** **(lb ai/Acre)**	**Comments**	**Manufacturer**
264-465	Mocap 10% Granular Lock ‘n Load	10%	Banana - 0.1323 (6 g/0.2 oz) Beans - (2-8) Cabbage - (2-5) Corn - (1-6) Cucumber - 2 Peanut - (2-6) Plantain - 0.1323 (6 g/0.2 oz) Potato - White - (3-12) Potato - Sweet - (3-8) Sugarcane - (2-4) Tobacco - (2-12)	REI - 48 hours (Where rain <25"/yr - 72 hrs.) Aircraft mentioned in PPE section of label. Aerial application to potatoes permitted. [Per EPA: Peanut pegging to be deleted]	Rhone Poulenc AG

Attachment 1 Summary - Ethoprop Pesticide Product Labels					
EPA Registration No.	**Product Name**	**Percent A.I.**	**Crop & (Min/Max Application Rates)** **(lb ai/Acre)**	**Comments**	**Manufacturer**
264-469	Mocap 20% Granular Lock ‘n Load	20%	Corn - (1- 6) Potato - White - (3-12) Sugarcane - (2-4)	**Restricted Use** Applied by aircraft or ground (LUIS). Aircraft mentioned in PPE section of label. Aerial application to potatoes permitted. REI - 48 hours (Where rain <25"/yr - 72 hrs.) N.B. Incorporation of granules at end of rows “should” or “can” be performed.	Rhone Poulenc AG

Attachment 1 Summary - Ethoprop Pesticide Product Labels					
EPA Registration No.	**Product Name**	**Percent A.I.**	**Crop & (Min/Max Application Rates)** **(lb ai/Acre)**	**Comments**	**Manufacturer**
264-457	MOCAP 15% Granular	15%	Banana - 0.1323 (40 g or 1.3 oz product) Beans - (1.95 -8.1) Cabbage - (1.95-5.1) Corn - (1- 6) Cucumber - 1.95 Peanut - (1.95-3.9) Plantain - 0.1323 (40 g) Potato - White - (3-12) Potato - Sweet - (3-8.1) Sugarcane - (1.95-3.9) Tobacco -(1.95-12)	**Restricted Use** Do not apply in Long Island , NY May be applied by aircraft or ground Aerial application to potatoes permitted. [Per EPA: Peanut pegging to be deleted] Not recom'd for tobacco in FL	Rhone Poulenc AG
359-703 - transferred to 264-465 SLN No. OR-840010	Mocap 10% Granular	10%	Potatoes - White - 6	WA, OR only Sec. 24C 6/21/85, postplanting broadcast to potatoes No earlier than 3 weeks pre-plant	Rhone Poulenc AG
264-465 SLN No. OR-96001700	Mocap 10% Granular	10%	Sweet Corn - (2-6)	OR only; 1 week pre-plant limit, broadcast.	Rhone Poulenc AG

Attachment 1 Summary - Ethoprop Pesticide Product Labels					
EPA Registration No.	**Product Name**	**Percent A.I.**	**Crop & (Min/Max Application Rates)** **(lb ai/Acre)**	**Comments**	**Manufacturer**
264-465 SLN No. PR 92-0002	Mocap 10% Granular	10%	Pineapple (0.6-1.2)	Band application 120 DTH	Rhone Poulenc AG
264-546	Chipco MOCAP 10G GC - granular	10%	Golfcourse Turf grass - (10-20)	"Not for use on domestic turf grass." "Do not apply with equipment carried on the chest or applicators... likely to grind the granules..." Ref. to unpleasant odor of mercaptan breakdown product. Max label rate is 40 lbs ai/A/year	Rhone Poulenc AG
359-703 - transferred to 264-465 SLN #WA8500800	Mocap 10% granular	10%	Potato - 6	WA & OR	Rhone Poulenc AG
359-703 - transferred to 264-465 SLN# FL8500100	Mocap 10% granular	10%	Sugarcane - (2-6)	FL - band, furrow, broadcast	Rhone Poulenc AG
359-703 - transferred to 264-465 SLN#ME93000300	Mocap 10% granular	10%	Potato - 3	ME - Only one application/crop	Rhone Poulenc AG

Attachment 1 Summary - Ethoprop Pesticide Product Labels					
EPA Registration No.	**Product Name**	**Percent A.I.**	**Crop & (Min/Max Application Rates)** **(lb ai/Acre)**	**Comments**	**Manufacturer**
34704-710	Holdem Insecticide Nematicide - granular	10%	Corn - (3-6)	**Restricted Use** Also contains 10% Phorate REI = 48 hrs (Where rain <25"/yr - 72 hrs.) Respirator req'mt Refers to aircraft in PPE section of label DTH=45 days	Platte Chemical Co.
34704-710 SLN No. OR-950027	Holdem Insecticide Nematicide - granular	10%	Field grown Lily bulbs - 4	**Restricted Use** Also contains 10% Phorate REI = 48 hrs (Where rain <25"/yr - 72 hrs.) Curry County, OR 1 app only Aug to Dec at planting	Platte Chemical Co.

Attachment 1 Summary - Ethoprop Pesticide Product Labels					
EPA Registration No.	**Product Name**	**Percent A.I.**	**Crop & (Min/Max Application Rates)** **(lb ai/Acre)**	**Comments**	**Manufacturer**
264-458	Mocap EC Nematicide-Insecticide	69.6%	Banana - 0.1323 (8 ml) Beans - (2-8) Cabbage - 5 Corn - 3?? Citrus Seedlings - 0.075/gal Cucumber - 2?? Peanut - (4.5-6) Pineapple - (3-6) Plantain - 0.1323 (8 ml) Potato - White - (4-12) Potato - Sweet - (6-8) Sugarcane - (2-4??)* Tobacco - (2-12) Ornam'tl - (3-6)	**Restricted Use** **No aerial appln to potatoes in Pacific Northwest** REI - 48 hours (Where rain <25"/yr - 72 hrs.) Do not apply within 140 feet of inland freshwater habitats; on Atlantic seaboard, do not apply within 800 feet of brackish water habitats. Do not apply in Long Island, NY. Do not use on tobacco in FL. *No row spacing given for sugarcane banded furrow application. (Assumed 72") Citrus: Non bearing; dip treatment, drench, soil band & incorporation Pineapple (HI only);drip irrig'n; DTH=120; 48 lbs ai/A/crop limit	Rhone Poulenc AG

Attachment 1 Summary - Ethoprop Pesticide Product Labels					
EPA Registration No.	**Product Name**	**Percent A.I.**	**Crop & (Min/Max Application Rates)** **(lb ai/Acre)**	**Comments**	**Manufacturer**
264-458 [SLN OR-960018]	Mocap EC Nematicide-Insecticide	69.6%	Sweet corn - (2-6)	OR only Broadcast	Rhone Poulenc AG
264-458 [SLN FL-870001]	Mocap EC Nematicide-Insecticide	69.6%	Nonbearing Citrus -5	DTH=365 2 apps/season limit Band & irrigation. Broadcast spray to ground and to tree trunks. **Refers to retail greenhouses and golfcourses**	Rhone Poulenc AG
II. <u>Products NOT Currently Marketed</u> (Registrant has stated that these lables are "not in active use."					
264-459	Mocap Plus Nematicide Insecticide for Tobacco	10%	Tobacco (2-8)	**Restricted Use** Also contains 5% Disulfoton REI = 24 hours Bee Caution Respirator reqmt. PPE label refers to aircraft Do not apply in Long Isl. NY. Not recom'd in FL	Rhone Poulenc AG

Attachment 1 **Summary - Ethoprop Pesticide Product Labels**					
EPA Registration No.	**Product Name**	**Percent A.I.**	**Crop & (Min/Max Application Rates)** **(lb ai/Acre)**	**Comments**	**Manufacturer**
264-521 Conditional Reg'n	Holdem Brand Granular Insecticide Nematicide {NOTE: Attached letter dated 4/13/93 refers to data reqmts.}	10%	Potato - (2.7-3.4)	**Restricted Use** REI - 48 hours (Where rain <25"/yr - 72 hrs.) Also contains 10% Phorate Respirator reqmt. PPE label refers to aircraft Bee warning DTH = 90 days, min row spacing 32"; 1 app/year	Rhone Poulenc AG
51036-80	Micro- Flo PCNB-M 10-3G	3%	Peanuts - 3 (at early pegging)	Suspended Product? Also contains 10% PCNB REI - 48 hours Respirator reqmt.	Micro-Flo Co.
264-475	Mocap PCNB 3-10 Granular nematicide-insecticide	3%	Peanuts - 3 (at early pegging)	Also contains 10% PCNB REI - 48 hours (Where rain <25"/yr - 72 hrs.) PPE mentions aircraft	Rhone Poulenc AG

Attachment 1 Summary - Ethoprop Pesticide Product Labels					
EPA Registration No.	**Product Name**	**Percent A.I.**	**Crop & (Min/Max Application Rates)** **(lb ai/Acre)**	**Comments**	**Manufacturer**
264-464	Mocap Plus 4-2 EC Nematicide- Insecticide	46%	Tobacco - (6-8)	**Restricted Use** Also contains 23% disulfoton. REI - 48 hours (Where rain <25"/yr - 72 hrs.) Do not apply via irrigation or in Long Island, NY. PPE section mentions aircraft Respirator reqmt. Bee Caution N.B. Listed in "**Crop Protection Reference**," (1997).	Rhone Poulenc AG

Attachment 1 **Summary - Ethoprop Pesticide Product Labels**					
EPA Registration No.	**Product Name**	**Percent A.I.**	**Crop & (Min/Max Application Rates)** **(lb ai/Acre)**	**Comments**	**Manufacturer**
264-541	Mocap GEL Nematicide-Insecticide Gel-Tec Water Soluble Paks	68.2%	Beans - (2-8) Cabbage - 5 Corn - 3??band Cucumber - 2??band Peanut - (4-6) Pineapple - (3-6) Potato - White - (4-12) Potato - Sweet - (6-8) Sugarcane - (*****2-4??) Band Tobacco - (2-12) Ornam'tl - (3-6)	**Restricted Use:** broadcast, band, irrigation REI - 48 hours (Where rain <25"/yr - 72 hrs.) Do not apply via irrigation or in Long Island, NY. **Do not make aerial applns to potatoes** and pre-plant only. PPE mentions aircraft Respirator reqmt. Pineapple - HI only Do not apply in Long Island, NY. Not recommended for tobacco in FL. Posting requirements for chemigation. *****No row spacing given for sugarcane banded furrow application	Rhone Poulenc AG

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF

PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

March 9, 1998

MEMORANDUM

SUBJECT: Review of Ethoprop Incident Reports
DP Barcode D243371, Chemical #041101, Reregistration Case #0106

FROM: Jerome Blondell, Ph.D., Health Statistician
Chemistry and Exposure Branch 2
Health Effects Division (7509C)

Monica F. Spann, M.P.H., Environmental Health Scientist
Chemistry and Exposure Branch 2
Health Effects Division (7509C)

THRU: Susan V. Hummel, Senior Scientist
Chemistry and Exposure Branch 2
Health Effects Division (7509C)

TO: Kathryn Boyle, Chemist
Reregistration Branch 1
Health Effects Division (7509C)

BACKGROUND

The following data bases have been consulted for the poisoning incident data on the active ingredient Ethoprop (PC Code: 041101):

1) OPP Incident Data System (IDS) - reports of incidents from various sources, including registrants, other federal and state health and environmental agencies and individual consumers, submitted to OPP since 1992. Reports submitted to the Incident Data System represent anecdotal reports or allegations only, unless otherwise stated. Typically no conclusions can be drawn implicating the pesticide as a cause of any of the reported health effects. Nevertheless, sometimes with enough cases and/or enough documentation risk mitigation measures may be suggested.

2) Poison Control Centers - as the result of Data-Call-Ins issued in 1993, OPP received Poison Control Center data covering the years 1985 through 1992 for 28 organophosphate and carbamate

chemicals. Most of the national Poison Control Centers (PCCs) participate in a national data collection system, the Toxic Exposure Surveillance System which obtains data from about 70 centers at hospitals and universities. PCCs provide telephone consultation for individuals and health care providers on suspected poisonings, involving drugs, household products, pesticides, etc.

3) California Department of Food and Agriculture (replaced by the Department of Pesticide Regulation in 1991) - California has collected uniform data on suspected pesticide poisonings since 1982. Physicians are required, by statute, to report to their local health officer all occurrences of illness suspected of being related to exposure to pesticides. The majority of the incidents involve workers. Information on exposure (worker activity), type of illness (systemic, eye, skin, eye/skin and respiratory), likelihood of a causal relationship, and number of days off work and in the hospital are provided.

4) National Pesticide Telecommunications Network (NPTN) - NPTN is a toll-free information service supported by OPP. A ranking of the top 200 active ingredients for which telephone calls were received during calendar years 1984-1991, inclusive has been prepared. The total number of calls was tabulated for the categories human incidents, animal incidents, calls for information, and others.

ETHOPROP REVIEW

I. Incident Data System

Please note that the following cases from the IDS do not have documentation confirming exposure or health effects unless otherwise noted.

Incident#690-1

Suicide was attempted by a chronic alcoholic, chronic smoker, and HIV+ man who ingested an unknown quantity of ethoprop (10% granular). The patient experienced respiratory arrest but recovered with rapid and intensive treatment.

Incident#749-1

A pesticide incident occurred in 1993, when a young child, who was hospitalized, ingested an unknown quantity of ethoprop.

Specific symptoms were not mentioned. No further information on the disposition of the case was reported.

Incident#1184-1

A pesticide incident occurred in 1994, when a man mowed the tees at a golf course that was treated with ethoprop several hours earlier and experienced dizziness, nausea, headaches, and pinpoint pupils. No further information on the disposition of the case was reported.

Incident#1710-1

A pesticide incident occurred in 1994, when a twenty-two year old man sprayed fields without a mask with ethoprop and experienced vomiting several times, constricted pupils, and flushed skin. No further information on the disposition of the case was reported.

Incident#2721-1

A pesticide incident occurred in 1995, when a man, who was not wearing PPE, was changing screens and was exposed dermally and by inhalation. Specific symptoms were not mentioned. No further information on the disposition of the case was reported.

Incident#2721-2

A pesticide incident occurred in 1995, when a woman, who was not wearing PPE, was exposed by inhalation while cleaning up ethoprop bags. Specific symptoms were not mentioned. No further information on the disposition of the case was reported.

II. Poison Control Center Data

Ethoprop was one of 28 chemicals for which Poison Control Center (PCC) data were requested. The following text and statistics are taken from an analysis of these data; see December 5, 1994 memo from Jerome Blondell to Joshua First.

The 28 chemicals were ranked using three types of measures: (A) number and percent occupational and non-occupational adult exposures reported to PCCs requiring treatment, hospitalization, displaying symptoms or serious life-threatening effects; (B) California data for handlers and field workers comparing number of agricultural poisonings to reported applications; and (C) ratios of poisonings and hospitalization for PCC cases to

estimated pounds reported in agriculture for pesticides used primarily in agriculture.

A. Occupational and Non-occupational Exposure

There were a total of 75 ethoprop cases in the PCC data base. Of these, 31 cases were occupational exposure; 26 (84%) involved exposure to ethoprop alone and 5 (16%) involved exposure to multiple chemicals, including ethoprop. There were a total of 38 adult non-occupational exposures; 32 (84%) involved this chemical alone and 6 (16%) were attributed to multiple chemicals.[1]
In this analysis, four measures of hazard were developed based on the Poison Control Center data, as listed below.

1. Percent of all accidental cases that were seen in or referred to a health care facility (HCF).

2. Percent of these cases (seen in or referred to HCF) that were admitted for medical care.

3. Percent of cases reporting symptoms based on just those cases where the medical outcome could be determined.

4. Percent of those cases that had a major medical outcome which could be defined as life-threatening or resulting in disability.

Exposure to ethoprop alone or in combination with other chemicals was evaluated for each of these categories, giving a total of 8 measures. A ranking of the 28 chemicals was done based on these measures with the lowest number being the most frequently implicated in adverse effects. Table 1 presents the analyses for occupational and non-occupational exposures.

Table 1: Measures of Risk From Occupational and Non-occupational Exposure to Ethoprop Using Poison Control Center Data from 1985-1992[a]

	Occupational Exposure	Non-occupational Exposure
Percent Seen in HCF		
Single chemical exposure	80.8[*6] (68.2)	50.0 (44.0)
Multiple chemical exposure	80.6[*6] (69.8)	55.3 (46.1)

[1] Workers who were indirectly exposed (not handlers) were classified as non-occupational cases.

Percent Hospitalized		
Single chemical exposure	19.0 (12.2)	18.8[*6] (9.9)
Multiple chemical exposure	16.0 (14.3)	14.3 (12.6)
Percent with Symptoms		
Single chemical exposure	87.5[b] (85.8)	83.3[*5b] (74.0)
Multiple chemical exposure	90.0[b] (85.8)	87.5[*4b] (75.2)
Percent with Life-threatening Symptoms		
Single chemical exposure	0.0[b] (0.0)	0.0[b] (0.0)
Multiple chemical exposure	0.0[b] (0.5)	0.0[b] (0.05)

a Extracted from Tables 2, 3, 5 and 6 in December 5, 1994 memo from Jerome Blondell to Joshua First; number in parentheses is median score for that category.
Top 25% of chemicals are ranked with a superscript of 1 to 7
b The percents calculated here is based on fewer than 25 cases and are not considered reliable.

Compared to other organophosphate and carbamate insecticides, ethoprop had above average evidence of effects, though for some measures (percent with symptoms or life-threatening symptoms) the number of cases was too few to provide reliable percentages (Table 1). For both the occupational and nonoccupational categories, ethoprop cases were nearly twice as likely to require hospitalization as did cases due to other cholinesterase inhibitors.

B. Ratios of poisoning - California Data

It is not possible to compare numbers of ethoprop poisoning in California to the number of applications because there have not been enough reports of systemic poisonings from 1982 through 1995. During this time period, there was only one occupational case reported for an applicator. However, there have been relatively limited use of ethoprop in California. From 1990 through 1994, total commercial applications ranged from 188 to 340.

C. Exposure in Children

A separate analysis of the number of exposures in children five years of age and under from 1985-1992 was conducted. For ethoprop, there were 6 incidents involved exposure to ethoprop alone. This number of cases was too few to warrant comparisons with other organophosphates and carbamates.

III. California Data - 1982 through 1995

Detailed descriptions of 11 cases submitted to the California Pesticide Illness Surveillance Program (1982-1995) were reviewed. In all of these cases, ethoprop was used alone and was judged to be responsible for the health effects. Only cases with a definite, probable or possible relationship were reviewed. Ethoprop ranked 76th as a cause of systemic poisoning in California. One individual was hospitalized between 1982 and 1994. Table 2 presents the types of illnesses reported by year. Table 3 gives the total number of workers that took time off work as a result of their illness and how many were hospitalized and for how long.

Table 2: Cases Due to Ethoprop Exposure in California Reported by Type of Illness and Year, 1982-1995

Year	Illness Type					
	Systemic[a]	Eye	Skin	Resp.	Comb[b]	Total
1982	-	-	-	-	-	-
1983	-	-	-	-	-	-
1984	-	-	-	-	-	-
1985	-	-	-	-	-	-
1986	-	-	-	-	-	-
1987	-	-	-	-	-	-
1988	-	-	-	-	-	-
1989	8	1	-	2	-	11
1990	-	-	-	-	-	-
1991	-	-	-	-	-	-

Year	Illness Type					
	Systemic[a]	Eye	Skin	Resp.	Comb[b]	Total
1992	-	-	-	-	-	-
1993	-	-	-	-	-	-
1994	-	-	-	-	-	-
1995	-	-	-	-	-	-
Total	8	1	-	2	-	11

[a] Category includes cases where skin, eye, or respiratory effects were also reported
[b] Category includes combined irritative effects to eye, skin, and respiratory system

Table 3: Number of Persons Disabled (taking time off work) or Hospitalized for Indicated Number of Days After Ethoprop Exposure in California, 1982-1995.

	Number of Persons Disabled	Number of Persons Hospitalized
One day	-	-
Two days	-	-
3-5 days	1	1
6-10 days	-	-
more than 10 days	-	-
Unknown	-	-

A total of 8 persons had systemic illnesses or 72.7% of 11 persons. A variety of worker activities were associated with exposure to Ethoprop as illustrated in Table 4 below.

Table 4: Illnesses by Activity Categories for Ethoprop Exposure in California, 1982-1995

Activity Category[a]	Illness Category					
	Systemic[b]	Eye	Skin	Resp.	Comb[c]	Total
Applgrou	1	-	-	-	-	1
Driftnon	7	1	-	2	-	10
Total	8	1	-	2	-	11

[a] Applgrou= ground applicator; Driftnon= non-occupational exposure to drift
[b] Category includes cases where skin, eye, or respiratory effects were also reported
[c] Category includes combined irritative effects to eye, skin, and respiratory system

According to the above activity categories, driftnon (non-occupational exposure to drift) was associated with the majority of the exposures. These illnesses included symptoms of shortness of breath, asthma, headaches, nausea, diarrhea, and burning eyes. A detailed investigation of the drift incident was performed by the California Department of Health Services and published in the Archives of Environmental Health by Ricard G. Ames, Ph.D., M.P.H. and James W. Stratton, M.D., M.P.H. (Acute Health Effects form Community Exposure to N-Propyl Mercaptan from an Ethoprop-Treated Potato Field in Siskiyou County, California, Volume 46, pages 213-217). Ethoprop had been applied at a rate of 12 pounds per acre (active ingredient) by air blasting onto the soil, tilling it in, and then irrigating the field. A questionnaire was distributed to over 900 households in the community within half a mile of the potato field where the drift/odor episode occurred and over 400 questionnaires were returned. Proximity to the potato field and perception of strong odor were used to estimate exposure to n-propyl mercaptan. Direct community contact with ethoprop was not probable because it was incorporated into the soil. Data analysis using logistic regression adjusted for age, sex and smoking status found that health effects were more likely among those smelling the odor. The most common effects associated with the odor were headache, diarrhea, runny nose, sore throat, burning/itching eyes, fever, and hay fever or asthma attacks. They concluded that the effects reported were due to the strong odor of n-propyl mercaptan, a contaminant and degradation product of ethoprop. They recommended that human exposures to n-propyl mercaptan be minimized to the extent practical “through pesticide use restrictions or modifications of agricultural practices.”

IV. NPTN

On the list of the top 200 chemicals for which NPTN received calls from 1984-1991 inclusively, ethoprop was ranked 182nd with 13 incidents in humans reported and 3 incidents in animals (mostly pets).

VI. Conclusions

Relatively few incidents of illnesses have been reported due to ethoprop. The careful investigation by the California Department of Health Services found that bystanders downwind from an ethoprop application experienced significant symptoms which were related to their perception of the strength of the odor of the mercaptan contaminant. A similar problem has been seen with DEF, another organophosphate that has a strong odor due to a mercaptan contaminant (butyl mercaptan which has a stronger, more offensive odor). Poison Center data suggest that exposures are more likely to require hospitalization than other cholinesterase inhibitors.

VII. Recommendations

Ethoprop does show a profile suggesting greater than average toxicity for a cholinesterase inhibitor. Application methods that prevent odor drifting to residential areas should be considered. A buffer zone of one-half mile from residential areas has been recommended for DEF which has butyl mercaptan as a contaminant. The contaminant for ethoprop has a less offensive odor but still strong enough to result in a large number of complaints from community members living near an application. A similar buffer zone should be considered for ethoprop. Alternatively, reducing the content of the contaminant n-propyl mercaptan, if practical, would be expected to reduce the complaints related to the strong odor.

cc: Correspondence
Ethoprop file (chemical no. 041101)
SRRD - Judith Loranger (7508W)

RDI: BRSrSci:SHummel: